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NOTES

ON

MATERIA MEDICA AND THERAPEUTICS

TAKEN FROM LECTURES DELIVERED

BY

PROF. WILLIAM H. THOMSON, M.D, LL.D.,

MEDICAL DEPARTMENT UNIVERSITY OF THE CITY OF NEW YORK.

EDITED BY

W. M. H. McENROE, M.D.,

ASSISTANT TO THE CHAIR OF MATERIA MEDICA, UNIVERSITY OF THE CITY OF NEW YORK.

FOURTH EDITION, COMPLETELY REVISED AND ENLARGED.

NEW YORK:
PRESS OF STETTINER, LAMBERT & CO.,
22, 24 & 26 READE STREET.
1880.

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PREFACE.

In preparing the fourth edition of these notes, the editor has been thoroughly mindful of the introduction of several valuable drugs since the publication of the last edition, and the prominence given in recent lectures by Prof. Thomson to some of these, and the desirability of having fuller notes on some of the older remedies, have rendered necessary the issue of the present edition. Advantage has been taken of the occasion to make what is practically a new work, for the present notes are based upon stenographic reports of the lectures delivered during the winter session of 1888–89, the material in the older editions for obvious reasons having been drawn upon to a slight extent only.

To render the work as complete as possible, several monographs by Prof. Thomson, bearing directly upon the uses and administration of drugs, have been introduced. Other new features are the frequent use of cross-references and a summary at the end of each of the principal drugs.

Owing to the nature of the work, the appearance of a few errors, typographical and otherwise, is almost unavoidable, but none of them, I trust, will be found misleading.

96390

To Mr. Edward Merrins I am indebted for the full and careful notes of Prof. Thomson's lectures, and for invaluable aid in the preparation of the material for the press.

If these notes are found helpful by the student, the object of their publication will have been attained.

W. M. H. McEnroe, M.D.

55 East 11th Street, October, 1889.

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CLASSIFICATION OF MEDICINES.

All Remedies may be divided into three classes: Medicinal, Non-Medicinal, and Disinfectant.

A Medicine is a remedy which cannot act until it enters the Circulation in a state of solution.

The circulation includes not only the blood, but also the interstitial fluid outside the capillaries, and which is the real nutritive fluid of the tissues. That it is in nearly as rapid movement as the blood itself, is shown by the quick diffusion of hypodermatic injections.

Non-medicinal Remedies are those which act without entering the Circulation, as Counter-Irritants, Blisters, Caustics, Electricity, Heat, Cold, Baths, Change of Scene or of Air, Massage, etc.

Disinfectants either destroy the agents which cause the decomposition of organic textures and fluids, or else neutralize the poisons generated by the growth or activity of those agents.

MEDICINES.

Medicines are divided into two classes: 1. Organic or Disease Medicines. 2. Functional or Symptom Medicines.

The Organic Medicines are those which act upon and modify the tissues or fluids of the body, so that after their action the system is not in the same state that it was in before their administration. Examples: Cod-Liver Oil in nutritive disorders, Iron in Anæmia, Mercury in Syphilis, etc.

The Functional Medicines produce no recognizable effect upon the various bodily organs, but affect their functions instead.

The function of an organ is its work, as Respiration the function of the Lungs; Circulation the function of the Heart and Blood Vessels; Secretion the function of the Glands, etc. Thus Ammonia may stimulate the heart's work and Aconite depress it, so as to accelerate or slow the circulation accordingly, but neither of these agents affects the structure of the heart itself. Opium or Tobacco leaves no traces on the Nerve Tissues, though taken for years for their effects on Nerve Functions.

The two Classes of Medicines present the following contrasts in their characters:

ORGANIC OR DISEASE MEDICINES.	FUNCTIONAL OR SYMPTOM MEDICINES.
They are given for Diseases or Morbid Conditions, not for Symptoms.	**They are given for Symptoms, not for Diseases.**
Thus Potassium Iodide is given not to relieve the pain of a syphilitic node, but to remove the node itself. They relieve symptoms, therefore, only indirectly, by removing their cause.	Thus Opium is given in inflammation, fractures, cancer, neuralgia, etc., only for what these have in common—the symptom pain.
They show the properties which lead to their use as medicines only in disease.	**Symptom Medicines act in health as well as in disease.**
Iron or Cod-Liver Oil does not strengthen persons in health. Mercury is a great restorer, provided there be Syphilis, etc. By a Morbid Condition, in distinction from a Disease, is meant a state like Anæmia or like Dropsy, which, though definite, yet is the result of quite different causes in different cases.	Emetics or Cathartics, or Neurotics, will act the same whether taken by the well or by the sick. Hence their actions are often studied by experiments on animals.
Their action is never secured by one dose, but only by repeated doses. They, therefore, require time for their operation, because they are cumulative, and hence their effect is more permanent.	**Their whole action is secured by one dose, and no different effect follows upon repeated doses. Hence they are not cumulative, and their effect is transient.**
	Thus half a dose of a Cathartic or of an Emetic fails to produce any characteristic effect. Repeated doses of a Neurotic, also, only repeat the symptoms of the first dose without adding any further effect on the disease or on the symptom. Thus Stramonium may relieve the symptom of spasm in asthma for a lifetime, but the last dose has no more helped to cure the asthma than the first one.

They should not produce symptoms. The patient should not know that he is taking anything except by noticing an improvement in his disease. Whenever they produce symptoms of their own, they are either given in excess or else they are not suited to the case.

Thus iron disagrees when it produces headache. Quinine should not be pushed beyond the symptoms of cinchonism. Mercury ceases to be remedial after salivation begins, and iodine after the symptoms of iodism develop, etc.

Disease Medicines are most commonly employed in the treatment of Chronic Diseases.

Thus Cod-Liver Oil, while valuable in Chronic Pulmonary Diseases, is useless in Acute Pneumonia. Iron is not given for the debility of fever, etc.

Chronic Diseases are due to faults of the constitution, either inherited or acquired, and hence only organic medicines can permanently benefit them. The term Chronic shows that they have no tendency to spontaneous recovery.

In some cases a Disease Medicine can be made to act as a Symptom Medicine, by giving it in the symptom way, viz., in one large dose. Thus Mercury in a large dose of calomel becomes a cathartic, but if so it ceases at once to act against any syphilis present in the system, for it cannot be both a Disease Medicine and a Symptom Medicine at the same time.

They do not act unless they do produce symptoms. The dose of all Symptom Medicines is the quantity which will produce the symptoms characteristic of the medicine, and nothing less.

Thus, while the ordinary dose of opium for an adult is one grain, it may require in peritonitis twenty grains before a symptom of opium is obtained; if so, the dose then is twenty grains.

Symptom Medicines are most commonly employed in the management of Acute Diseases.

Acute Diseases, as inflammations, fevers, etc., are of the nature of accidents and may occur in the young and healthy. If uncomplicated, Acute Diseases are self-limited and terminate, with rare exceptions, within six weeks. Symptom Medicines are called for in them to relieve suffering and to prevent complications, but not to cure the disease, which rather must be watched while it runs its course.

CLASS I.—ORGANIC OR DISEASE MEDICINES.

DIVISION I.—*Restoratives.*

CHARACTERS: I. They are medicines which are natural to the system, either because they are themselves ingredients thereof, or else analogous to what is so.

II. They act by making up a deficiency in the system, by being themselves the thing deficient, or else similar to it. They are, therefore, of the nature of foods, and hence are beneficial only when the system is starved of the ingredient to which they correspond. Examples: Iron in anæmia, Cod-Liver Oil when blood fat is wanting, etc.

Restoratives and Disinfectants are the only prophylactics.

DIVISION II.—*Alteratives.*

CHARACTERS: I. They are Organic or Disease Medicines unnatural to the system.

They are, therefore, more or less poisonous, and this fact is to be remembered, because, though all Symptom Medicines are also unnatural to the system, yet complete recovery from the most active of them, like Opium or Aconite, is a question of hours only, while recovery from the injury of organic poisons may be very slow.

II. They act in an unknown way only against certain special diseases or morbid conditions. The range of their remedial applications is therefore more limited than with restoratives.

Potassium Iodide acts promptly against syphilitic periostitis, but not to the same degree in other forms of periostitis. Colchicum is the remedy for gouty arthritis, but not for rheumatic arthritis, etc.

III. When they act as poisons they produce characteristic symptoms, such as salivation by mercury, or iodism, bromism, etc. When they do so, they cease to act as remedies, and the dose should be lessened to that which does not cause symptoms, or else they must be abandoned. As their poisonous effects are both different from their remedial effects and inconsistent with them, an important rule in their lengthened administration is to conjoin restoratives with them to postpone their poisonous effects as long as possible.

CLASS II.—FUNCTIONAL OR SYMPTOM MEDICINES.

Division I.—*Neurotics.*

Characters: I. They are medicines which produce their symptoms by affecting some nerve functions. Neurotics never act upon the whole nervous system, and hence the use of such terms as "general nervous stimulants or sedatives" is incorrect. The most widely operative neurotics, such as opium, are yet quite selective, and affect the functions of only a few out of the many nerve centres.

II. As they are purely functional remedies, neurotics cannot cure real nervous diseases like epilepsy, asthma, etc., as these diseases are generally the most constitutional of all diseases.

The effect of neurotics is usually weakened by repetition, so that the doses have to be increased. Yet they promote the action of organic medicines when they relieve special symptoms of the disease. Thus opium and conium materially increase the efficacy of potassium iodide in syphilitic periostitis when there is much pain, and on the same principle chloral, by lessening reflex excitability, assists the bromides in epilepsy.

Neurotics may be divided into:

a. Those which are both Stimulants and Sedatives (commonly called Narcotics). These agents generally stimulate some nerve functions, while they simultaneously depress others. Thus opium stimulates some of the higher cerebral functions and also stimulates the heart, and *at the same time* blunts sensation and paralyzes the alimentary canal.

Or else these agents first stimulate certain functions and afterwards depress the same, but secondarily from exhaustion.

b. Those which are Stimulants only of certain nerve functions. Examples: Ammonia on the heart, Valerian and Asafœtida on the abdominal ganglia, etc.

c. Those which are Sedatives only of certain nerve functions, as Hydrocyanic Acid of the respiratory function.

DIVISION II.—*Eliminatives or Glandular Medicines.*

CHARACTERS: I. These medicines increase gland secretion. They are given more against complications occurring in the course of acute or of chronic diseases than against mere symptoms.

Thus fever arrests secretion, and therefore, if long continued, endangers life by the complication of starvation from deficiency of digestive secretions in the alimentary canal, and by the complication of self-poisoning from retained excretions. Eliminatives here are useful, not to eliminate the disease, but to modify these complications.

II. By them also the different gland secretions are sometimes made to act vicariously for some one deficient gland function, as when Cathartics and Diaphoretics are used in kidney disease.

These medicines are divided into:

a. Cathartics, which increase the secretion of the intestines.

b. Emetics, which act upon the secretions of the pharynx, stomach, liver, and duodenum in the act of emesis.

c. Diuretics, which act on the kidneys.

d. Diaphoretics, which act on the skin.

e. Expectorants, which act on the bronchial secretion.

Division III.—*Astringents.*

Characters: These medicines constringe muscular and fibrous tissues and diminish secretion. They are also employed for arresting hæmorrhage by coagulating the blood.

They are divisible into:

a. Mineral Astringents.

b. Vegetable Astringents.

PART I.

DISINFECTANT REMEDIES.

DISINFECTANT REMEDIES.

GENERAL INTRODUCTORY.

Disinfectants are remedies which are used for the prevention of those diseases which come to us from without, and are not directly due to anything which is in the system itself. These diseases are accidents, and have nothing of the nature of constitutional diseases.

The causes of these diseases are external, and the patient is not directly responsible for an attack unless he wilfully places himself in those surroundings where he knows the disease exists. Thus, two persons may be attacked by small-pox, one having unwittingly come in contact with a person suffering from the disease; to this man the disease is an accident. The other person wilfully, and with full knowledge of the fact, incurred the risk of infection; this cannot be called an accident. Nevertheless, to both persons the cause of the disease came from without their own bodies. It was an *external cause.*

It is now almost the unanimous opinion of the medical profession that these extraneous, accidental diseases—of which *small-pox* may be taken as a type—are caused by living organisms, not by any physical or chemical agency. Disinfection means simply the endeavor to destroy these organisms, either directly by the disinfectant employed, or indirectly by the production of an agent inimical to their vitality; and hence any disease against which disinfectants can be successfully employed must be produced by these organisms. To speak, therefore, of eliminating the "poison" in these diseases shows an erroneous conception of the nature of their cause, for, irrespective of the identification of the organisms by the microscope, the various processes occurring in the course of these accidental or "communicable" diseases differ in all their essential features from those produced by poisons. The word "poison" in its strict sense means a definite chemical substance, devoid of life, that produces disease or death after having entered the circulation; but the meaning of the term has been extended to embrace also those substances—*e.g.*, caustics—which cause death or serious bodily harm by their chemical action upon the tissues with which they come in contact. That these diseases are due to living organisms and not to poisons is conclusively shown by the following facts: (1) In poisons, quantity is an essential element: a certain amount will prove fatal, a lesser amount will not be fatal, and a minute amount may act medicinally. On the other hand, in these diseases quantity is unimportant, the small amount of virus introduced into a person's system by inoculation infecting him to as great an extent as though a much larger quantity had been used. (2) In the case of poisons, time is an unimportant element, for, though there may be delay in absorption, as soon as a poison enters the circulation its characteristic effects are immediately produced; but where diseases are dependent upon living organisms, there must be a certain period before the symptoms of disease are manifested. This latent period, called "incubation" (an unfortunate term, as it implies animal origin, and should be replaced by that of "germination"), is followed by the period of development, which is characterized by certain changes which are never reversed. (3) Following this period of development we have the most positive proof of the character of these morbid agents in the great feature of reproduction, as there is nothing in chemistry or physics that can reproduce itself. Thus, for example, the organisms in the minute quantity of variola lymph introduced into the system by inoculation reproduce themselves to such an extent as to enable us to obtain from the person so infected a quantity sufficient to infect multitudes. This element of reproduction is the cause, and the only cause, of these diseases being dangerous. Immunity from the effects of any one of them depends on the virus being unable to reproduce itself in the system of the person exposed to its influence, and, conversely, the severity of the disease will be in proportion to the receptivity of the soil on which these organisms—or, as they might be termed, seeds—will fall. Thus, of five persons exposed to the influence of one of these communicable diseases, two may be violently affected by it and die, two may be totally unaffected by it, and one may be affected slightly. With poisons, however, the results are invariable; a dose of strychnine, for instance, producing precisely the same effects in one person as in another. (4) The variations in type and severity of these diseases from year to year also show that they are dependent upon living organisms; for these variations never happen with poisons, but growths are constantly having fluctuations in their reproduction. (5) The transportation of poisons from one country to another does not affect their peculiar properties, but growths are very much affected by soil, climate, altitude, etc., and so we find that many of these diseases are endemic; for instance, cholera cannot ascend a mountain, and yellow fever is checked by frost.

It is thus shown that we have to deal with agents that live and grow, and which never originate spontaneously; and the microscope, which confirms these deductions, reveals to us the fact that we are living in an immense ocean of minute forms of organic life, compared with which the world of life we see around us with the naked eye is quite small. Reasoning from analogy, and from the fact that no form of life can live for itself, we should expect that this kingdom of microscopic life, by far the largest and most universal, must have very important relations to other departments of life, and this we find to be the case. Without the aid of these minute organisms there would be no vegetable growth, as the fermentation they produce is essential to the fertility of the soil; for it has been found that soil which has been sterilized will not support vegetable life. To a very large extent they furnish the microscopic nuclei to the atmosphere which serve for the precipitation of watery particles, and thus they assist in the formation of clouds; for in air which has been filtered through cotton, and thus rid of all solid matter, the introduction of steam is not followed by a "cloud" or "mist," but it immediately condenses as water. If, therefore, we were living in a perfectly pure atmosphere, there would be no clouds and consequently no rain; the whole earth would be a desert, for as fast as water was evaporated from the ocean it would return, unable to find a resting place for its particles. What is still more important, however, is the fact that if it were not for these organisms nature would very soon be choked with her own dead. Decomposition of either animal or vegetable substances never occurs spontaneously, but is brought about by the agency of these organisms in a complex series of processes. In the putrefaction of ordinary butcher's meat, no less than eight kinds of organic life, differing in form, activity, and chemical results, succeed each other, in an order which is rarely reversed, before decomposition is complete, the processes being analogous to those in the decomposition of vegetable matter—*e.g.*, alcoholic fermentation, where the alcoholic plant is succeeded by the acetic acid plant. These facts have an important and significant bearing on the subject of the growth of the organisms by which communicable diseases are produced, and they direct attention to a stage (the post-latent) of these diseases to which heretofore there has not been attached sufficient importance, but to which these facts give a very decided clue as to its actual existence.

Communicable diseases are characterized by a "latent stage," or, as it might now more correctly be termed, a "pre-latent stage"—the period of incubation or germination. This is followed by the period of development, after which comes the period of reproduction, to be succeeded by the apparent recovery of the patient. But the disease has not yet been conquered; the recovery is only apparent, for there now succeeds another latent stage, which may be termed the "post-latent." For instance, at the end of a certain time the kidneys may be affected after an attack of scarlet fever, and paralytic troubles may follow diphtheria; measles may end in chronic asthma, and measles and scarlet fever may both be succeeded by nasal catarrh and otorrhœa. These manifestations of the post-latent stage are not the sequelæ of the original complaint, but are indications of a new disease due to the development of other bacterial growths, because every one of these diseases due to an organism of its own prepares the way for another disease which but for it would not appear. We are thus living in a world of life which is ever ready to seize upon and destroy anything that shows a weakened vitality—a vitality insufficient to repel or overcome them.

This subject should be thoroughly studied, not so much to discover this or that disease, as to enable us to grasp the general laws of this microscopic world, and to infer from them facts which would be obscure if we studied the specific forms by themselves. For instance, in phthisis, a bacterial disease—the microscope here affording us a means of diagnosis superior to that of physical exploration, as we can by its use determine with certainty the presence of the disease where otherwise we would be in doubt—there is the suggestive fact that it does not prevail anywhere in the world where the soil is permeable to water to the depth of about thirty feet; but in proportion as we come to soil which holds water two or three feet below the surface of the earth, there phthisis most extensively prevails. This disease, therefore, is due to the introduction into the system of germs which are dependent upon a certain condition of the soil, not to atmospheric bacteria; hence to get rid of the disease the soil must be dealt with.

In regard to the probable action of these germs[1] in producing disease, there is no doubt but that the blood, in a large proportion of cases, is the medium of infection; for instance, in anthrax the bacilli seem to originate and multiply in the red blood-corpuscles, rendering them unfit to carry on their functions and thus causing death. More commonly, however, their action is by the generation of a poison,[1] as in septicæmia.[2] Since the identification of the bacillus of Asiatic cholera, attention has been directed to the alimentary canal as the seat of generation of morbid bacteria. This disease and those of common cholera, yellow fever, dysentery, cholera infantum, etc., are now supposed to be due to the development of bacteria in the intestines.

---

[1] Bacteria are simple, microscopic, vegetable cells, usually very minute, composed of protoplasm with perhaps an enveloping membrane. They multiply often with great rapidity by transverse division or by the formation of spores, the latter being vastly more resistant to destructive influences than the bacteria themselves. According to shape, they are divided into (1) *micrococci*, round or sphæro-bacteria: (2) *bacilli*, or *desmo-bacteria*, rod-shaped bacteria; (3) *spirillæ*, or *spirochætæ*, spiral-shaped bacteria. The micrococci of pus occur singly or in irregular clusters called staphylococci, or in chains called streptococci. The forms most frequently found in the pus of acute abscesses are the staphylococcus pyogenes aureus and the streptococcos pyogenes albus. There are a great many other varieties of micrococci, but these are the principal.

The extraneous or accidental diseases due to the presence in the system of some form of organic life may be divided into two classes, each with its special distinctive marks: (1) the "communicable"; (2) the "non-communicable."

I. *Communicable Diseases.*—In this class it is necessary that the disease shall have previously existed as such in an animal body, and its reproduction in the newly infected person be merely a succession of kind. Usually, infected animals communicate the disease to members of the same species, as man to man, but sometimes the disease is conveyed from man to animals and *vice versa.* The term "communicable" is used advisedly to designate this class of diseases, in preference to the word "contagious," for the derivation of the latter term conveys the erroneous impression that contact is necessary to the spread of the disease. In former days, this impression was the cause of very dangerous confusion; for if a disease actually spread from one person to another, and yet did not affect those who touched the patient, it was not considered to be contagious, but due to something in the air, and hence no precautions were taken. On this account, Asiatic cholera, a very communicable but not a contagious disease, carried off thousands upon thousands; but when this disease last appeared in New York, all houses were thoroughly disinfected, and the disease was stamped out with the same directness that firemen stop a conflagration. The virus of this disease (as well as of some others of this class), when it leaves one body, is not immediately ready to enter another, but seems to pass through an intermediate stage upon the surface of the ground or in the air; but it is just as communicable as that of small-pox, and no case of cholera occurs without the infection coming from one who has the disease. The word "contagion" proposed to define the mode of communication; the term "communicable" does not.

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[1] The word is here used in its stricter meaning. For definition, see *ante,* p. 12.

[2] *Septicæmia* is a condition of the body produced by the presence of an extremely virulent poison, the product of the growth of certain forms of bacteria, which has a tendency to precipitate the fibrin-producing elements of the blood and to cause the formation of minute emboli. The poison is a definite chemical substance, devoid of life, and consequently producing effects corresponding to the amount absorbed. Septicæmia may be produced by pyæmia.

Pyæmia is a condition of the body caused by the presence of morbific bacteria, which are capable of multiplying themselves to such an unlimited extent as to cause death, either physically by interference with the vital functions, or chemically by the production of a virulent poison. Pyæmia is never the result of septicæmia, but may cause it.

The communicable diseases are subdivided into two classes:

1. *Specific.*—In this class each disease has its own marked or distinctive symptoms, which are invariably produced in new cases. These cases are the reproduction of the original disease, which is never changed into any other form by pre-existing or intercurrent diseases. Examples: measles, small-pox, scarlet fever, etc.

2. *Septic.*—The diseases in this subdivision have certain class characters, but it is impossible to predicate the form they will take in every new case. Thus the introduction of erysipelas into a surgical ward is apt to develop pyæmia, while, if introduced into an obstetrical or gynæcological ward, puerperal fever, peritonitis, septicæmia, etc., are induced. The cause of these diseases is one and the same, but its manifestations vary according to the soil on which it falls.

II. *Non-communicable Diseases.*—These diseases are caused by morbific agents which do not come from an animal body, but have their origin in a place or thing. Many of them are conveyed through the air or water, and these diseases are usually termed malarial; but as the germs are carried as often, if not more often, by water than by air, the term (meaning "bad air") is an unfortunate one; and "miasmatic," also used to designate them, is equally unfortunate. The germs may also have been conveyed from the soil or from articles of clothing. Thus in *yellow fever* the infection is far more likely to be carried by wearing apparel, holds of ships, etc., than by the air. This is proved by the fact that the physicians and nurses, who attend cases of yellow fever after they have been sent to the hospital and divested of their clothing, *never* catch the disease, while the quarantine physicians, and those brought in contact with the clothing and surroundings of the patients on their arrival, are almost invariably stricken with the disease.

Therefore, if patients suffering from these diseases are withdrawn from the infected localities, they may freely be admitted among those in health, as they no more communicate the disease to others than a person could communicate the injurious effects of a dose of arsenic. Another peculiarity about this class is that the infection may be confined to a very circumscribed space. Hence, for instance, if one small room should be omitted in the general disinfection of a ship in which there have been cases of yellow fever, persons entering that room are liable to the infection.

CLASSIFICATION OF "ACCIDENTAL" DISEASES.

- Accidental diseases.
  - 1. *Communicable.* Origin in animal body.
    - (*a*) Specific.—Measles.
      - Scarlet Fever.
      - Small-pox.
      - Typhus Fever.
      - Typhoid Fever.
      - Asiatic Cholera, etc.
    - (*b*) Septic.—Erysipelas, and diseases to which it gives rise, etc.
  - 2. *Non-communicable* [syn *infectious, malarial, miasmatic*]. Origin in place or thing not in animal body.
    - Yellow Fever.
    - Malarial Fevers.

CLASSIFICATION OF PRINCIPAL DISINFECTANTS.

General Disinfectants.	Special Disinfectants.		
	Carbolic Acid Class.	Chlorine Class.	Unclassified.
Free ventilation	**Carbolic acid**	**Chlorine and compounds**	**Lime**
Absence of air	**Creosote**	**Bromine and compounds**	**Charcoal**
Extreme heat	**Salicin and compounds**	**Iodine and compounds**	**Corrosive sublimate.**
Extreme cold	**Naphthaline and compounds**		**Boracic acid**
Water	**Chinoline and compounds**		**Permanganate of Potash**
Perfect dryness	**Benzoin and compounds**		**Sulphur and compounds**
	Camphor		
	Thymol and compounds		
	Oil of peppermint		
	Oil of wintergreen		

GENERAL DISINFECTANTS.

All forms of life, especially those with no protective covering, live in a medium of very narrow range, and hence, as the action of disinfectants is explicable only upon the supposition that they destroy life, total opposites, as *extreme heat* and *extreme cold*, are equally effective. Thus, if the infected clothes of a yellow-fever patient are heated in a temperature of from 300° F.–400° F., the germs will be destroyed; but frost will destroy them equally well. **Water** is a good disinfectant (and before a surgical operation the body should be thoroughly washed), but *perfect* *dryness* is better yet; for in the deserts of Arabia, where dead bodies are frequently left exposed to the air, they are never found in a putrefactive condition, but in a state of desiccation. The germs will cease to exist in the *absence of all air*, hence canned goods, but a *free supply of oxygen* will answer the same purpose just as well; for if plenty of fresh air be admitted into a room on the walls of which various fungi are growing, they will disappear. This has an important practical bearing on the treatment of those common and dangerous diseases connected with the bacteria of pus, which are particularly unable to stand much oxygen, and brings up the subject of climatology. For instance, in *tubercular inflammation of the lungs*, where the severity of the disease is due to their necessarily unresting condition, it depends upon the locality whether pus, with the consequent ulcerative processes, will be present or not. The tubercle bacilli, were it not for their dangerous alliance with pus bacteria, would be relatively inert, and against the latter pure air is the best disinfectant. Hence phthisical patients should be advised to always have their bedroom windows well open (taking care to have the patients warmly covered), to live as much as possible in the open air, and, if a change of climate is to be made, to go where they can remain in the open air the longest, as an outdoor life will better enable them to contend with their disease. These are the general disinfectants, which should be used as much as possible with the special disinfectants now to be dealt with, main reliance being placed upon fresh air, particularly in cases of diarrhœa, dysentery, and children's diseases.

SPECIAL DISINFECTANTS.

Lime.—The power of lime as a disinfectant depends upon the following chemical and physical properties: (1) As a caustic alkali it destroys all forms of microscopic life brought in contact with it. (2) As quicklime it has the property of absorbing moisture to an extraordinary degree, and has a greater affinity for water in the tissues of growing forms of life than for water in its natural state, as in the former case the water is in a state of molecular division that subjects it more readily to chemical action. (3) During the process of hydration, intense heat is generated, which sets up currents in the surrounding atmosphere, and whatever germs are floating in the air are brought in contact with the lime and thus destroyed. (4) After hydration, lime is an antacid, preventing and destroying fermentation.

Uses as a Disinfectant.—Lime is the best of all disinfectants for those diseases due to germs having their habitat in the soil. It has already been stated that these soil bacteria are essential to vegetable growth, but many of them are capable of generating disease. This is proved by the fact that whenever the soil is upturned in this city (New York) for any distance, there is always an outbreak—usually within twenty-four to forty-eight hours thereafter—of various forms of disease, such as neuralgia, headache, sore throat, boils in the nose, and very serious malarial trouble, along the line of the excavations. Furthermore, nearly every house has a place perfectly adapted for the generation of these morbific agencies of the soil—viz., its cellar. Many of the diseases generally ascribed to sewer gas are really due to underground cellar air circulating through the house, especially during the night. One proof of this is that persons at work in sewers, while they may have symptoms of poisoning due to the inhalation of sulphuretted hydrogen, rarely have the sore throat with follicular tonsillitis, the headache, derangement of kidneys,[1] malaise, etc., characteristic of diseases due to germs emanating from the soil. We also find the additional fact that in a cellar population there is total absence of a healthy color in the faces of the children, and they are greatly troubled with tendency to diarrhœa, obstinate night cough, sore throat of a special kind, capricious appetites, and occasionally malarial disease. (Quinine should be administered in these cases.) Moreover, whenever the thermometer falls to about 10° above zero, there will be a general outbreak of malarial complaints, due to the warm air of the cellar ascending through the house, using the various partitions, crevices, holes in connection with gas pipes, etc., as conduits, until finally it reaches the top floor, where it remains. Hence the occupants of rooms on this floor are more likely to be affected than those on the floors immediately beneath. The cellar always has a musty smell, as if something were coming out of the ground, no matter how well ventilated it may be. How is this cellar air to be kept from infecting the house ? Lime is the only trustworthy agent for this purpose. Two pounds of lime will last for eight or ten days, except when the ground is surcharged with moisture, when it will have to be renewed more often.

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[1] One of the results of this derangement of the kidneys is the presence of blood, and consequently albumin, in the urine. Not unfrequently medical students who discover albumin in their urine imagine themselves to be in the incipient stages of Bright's disease, whereas the trouble is due to this malarial infection, contracted from occupying rooms on the top floors of houses in which cellar air ascends. Quinine should be taken.

Lime, both in the form of quicklime and as whitewash—hydrated lime, which, although no longer capable of absorbing vapor, retains its alkaline property and is a valuable adjunct to quicklime—should also be used in hospitals for ground disinfection and whenever there is an epidemic of *diphtheria* and of specific diseases of malarial type. It is also one of the best disinfectants against *typhus fever,* the disease that physicians should most dread, as more die from it than from any other one disease, and which is the most terrible of all where people, as in the hold of a ship, are crowded together. Wherever typhus fever prevails whitewash should be freely used. Unfortunately it is of little use against *typhoid fever.* To disinfect a ward of *hospital gangrene* and *erysipelas,* it should be thoroughly whitewashed every five days, as at the end of that time the whitewash has lost its most effective properties. Where rooms, owing to excessive dampness and imperfect ventilation, have various forms of fungi growing on the walls, fresh quicklime, in the proportion of one pound to a room twenty-eight feet square, will quickly destroy these germs.

As lime-water it is given internally to correct *acid fermentation* in the stomach and intestines, shown by sour vomit or ejecta.

Charcoal.—This is a purely physical agent, and operates as a disinfectant by its power of absorbing into its pores, and packing them away into a very small compass, many gaseous bodies and vapors—*e.g.*, it will absorb ninety times its own volume of ammonia. This property, though not an exception in the physical world (as it is possessed by all elementary substances in solid form), cannot be explained by any known physical laws, as no pressure is exerted. The dissolution of several substances in water without the latter increasing in bulk may afford some analogy, but does not solve the question, as this also is a mystery. That charcoal simply packs the gases away is shown by the fact that when subjected to a certain heat they are released, and the characteristic smell of the gases which the charcoal had deodorized returns with their expulsion. If it be a morbific gas which has thus been absorbed and expelled, does its power to produce disease return with the smell? A question such as this is based on the erroneous theory, which has not yet disappeared, that bad smells are in themselves the cause of disease, and that if a thing be deodorized it is necessarily disinfected. Nothing in the form of a gas is *per se* injurious unless it is so purely by reason of its chemical or physical properties. All morbific agents are solid bodies, and do not become a part of the medium in which they exist; for air may be freed from them by passing it through cotton wool, and those contained in water are unable to pass through a porcelain filter. When a thing smells bad, therefore, it is no proof that it is injurious; and, on the other hand, when we get rid of the smell it is by no means certain that we have done away with a cause of disease. Consequently, the value of an antiseptic or deodorizer is to be judged, not by its power of causing bad smells to disappear, but by its fatal effect upon low forms of life.

The uses of charcoal as a disinfectant are:

1. *As a Purifier of Drinking-Water.*—During the process of liberation from charcoal, gases are in their nascent state, and therefore much more active chemically. Oxygen (which is very readily given up by charcoal), when in this condition, is extremely fatal to all low forms of life, attacking cryptogamous plants and the coloring matter of vegetable tissues with great energy. Hence it is an admirable purifier of drinking-water by destroying those microscopic forms of vegetable life which are almost universally in the waters of this country, and, being itself insoluble, does not communicate any of its own properties to

the water. Therefore in malarious districts where *dysentery*, *diarrhœa*, etc., prevail, drinking-water should either be boiled or passed through a charcoal filter.

2. *As a Deodorizer.*—Charcoal is an almost perfect deodorizer, and therefore may be used to absorb the odor from ill-smelling surfaces of wounds, ulcers, gangrene, etc., by mixing it with the poultices.

3. *As an Internal Remedy.*—Where there is fermentation and putrefaction in the alimentary canal from the bile being withdrawn or perverted, with a consequent tendency to *dysentery*, *dyspepsia*, eructation of malodorous gases, fœtid discharges, etc., well-prepared charcoal (gr. x.–xx., t. i. d.) is both a corrective and curative, and does not counteract other antiseptics.

4. *As a Sanitary Agent.*—As charcoal operates differently to quicklime, large quantities of these substances may be used together in the disinfection of a house where there is bad drainage, the one rendering the other more operative, both acting independently.

Simply heating the charcoal will renew its powers of absorption where these have been lost from its constant use.

Carbolic Acid and allied compounds.—Carbolic acid is a chemical rearrangement of the particles of matter which make up vegetable tissue. It is obtained from coal tar by distillation and subsequent purification, many of its allied compounds being also products of this substance. Its action as a disinfectant depends more upon its destructive effects upon the vitality of matter than upon its chemical or physical properties.

Properties.—In tropical countries where, from the extreme fertility of the soil and consequent luxuriant vegetation, there is a struggle for existence among the various forms of plant life, Nature, ever careful to protect the reproductive function, has given to every seed its own peculiar secretion (which afterwards appears in the plant) to keep it from putrefaction and as a protection from attack either by fungi or insects. Herein lies the explanation of the antiseptic properties of substances derived from coal tar (obtained from coal, which is simply woody fibre that has been subjected to enormous pressure for ages), and those of the prodigious number of secretions of the nature of camphor, cinnamon, nutmeg, cloves, pepper, ginger, etc., closely allied to carbolic acid. The disinfecting and preserving power of this class is seen in the action of spices in preserving fruit; smoke (another member) has been used from time immemorial for the preservation of fish and meat. Wood soaked in coal tar resists decay. If a solution of carbolic acid, twenty grains to the pint, is injected into the veins of a corpse, it will preserve it for a long time. Oil of mustard, or simple powdered mustard, will remove the odor from the hands after working in the dissecting-room. Administered in large doses, carbolic acid, which may be taken as a type of the others, produces: (1) a weakening of the muscular contractions of the heart, which then beats faster to make up for deficiency of power, and ultimately symptoms of cardiac paralysis with distressing palpitation and feeble pulse; (2) a paralysis of all nervous phenomena, sensation being the most important, and hence it is an anæsthetic; (3) symptoms connected with the special senses indicative of weakness, one of the most common being *tinnitus aurium*, or ringing in the ears, followed by a neuralgic pain in the temples; (4) weakness of respiration, which sometimes suddenly stops, life usually ending in convulsions, generally of tetanic nature.

Carbolic acid and the other members of this class possess poisonous properties which enable them to restrain and finally abolish the vital properties of protoplasm, and they are therefore called paralyzers and antiseptics, in the sense that they will prevent decomposition due to the presence of bacteria by destroying them. Not a single form of living protoplasm can be brought in contact with carbolic acid without being destroyed; but, owing to the difficulty of absorption and the great protection afforded by basement membranes, the destructive effect of carbolic acid is not so great among the higher forms of life as in the microscopic world, where the lower we go the thinner becomes the external covering until we reach the fungi and algæ, which are immediately destroyed by it; and upon this property depends its value as an antiseptic. It is therefore not a universal disinfectant, and should be used, not against the specific or communicable diseases, but against septic diseases—those due to the decomposition of pus, where it is the disinfectant "par excellence."[1] A great many of these antiseptic remedies pass into the system in a state of solution, and go to every part of the body by the interstitial circulation. The first and best illustration of these is:

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[1] For the uses of carbolic acid in the treatment of wounds, etc., see p. 41.

Salicin.—As its name implies, salicin is a neutral principle, termed in chemistry a glucoside, obtained from the bark of different species of willow—order *salicaceæ*. It is found in long, fine silky crystals, of bitter taste and insoluble in water. From this principle are derived **salicylic acid** and the various salicylates. In large doses salicin will produce the same topical effects as a similar dose of carbolic acid, but not with equal severity; for the former has never caused death, the cases which have been so reported being due to the impurities combined with it, not to the salicylic acid itself. Along with these special actions, certain rheumatic affections, notably *acute articular rheumatism,* are very decidedly relieved from pain by salicylic acid. Acute articular rheumatism, which differs essentially in its origin and nature from chronic rheumatism, is a disease of early life, occurring most commonly between the ages of twenty and thirty, it being a very rare occurrence for a first attack to happen after forty years of age. Previous to fifteen years of age the disease assumes an entirely different form, appearing as *chorea,* or *St. Vitus' Dance.* Acute rheumatism is the worst form of rheumatism, because of its danger to the heart, which it affects independently of the severity of the attack or the number of joints affected. *Chronic rheumatism* is a disease of middle or late life, attacks the muscular tissues, and has no tendency to affect the heart. Salicylic acid has great power in diminishing the severity of the pain in acute rheumatism, and in reducing the swelling and inflammation, and therefore seems to be a specific; but on examining the urine we find that the disease itself is not removed, nor is the liability of recurrence or heart disease prevented. Salicylic acid and its compounds simply relieve the symptoms, but do not cure the disease, and are therefore not specifics.

One of the compounds of salicin, **salicylate of soda,** when given in doses of from gr. xv.–xx. about an hour after each meal, is an admirable cholagogue; and salicylic acid is a very valuable remedy in *lumbago* and other diseases dependent on a disordered liver (dose, gr. xv., t. i. d.), operating as an anæsthetic and stimulating the secretion of the liver.

Salol.—This substance is a combination of salicylic acid with phenol, making a salt with pleasant taste and fragrant odor. It is insoluble in the stomach, is not usually dissolved by the pancreatic and biliary secretions, but, dissolving slowly in the intestines, salol and salicylate of soda are very valuable remedies for *intestinal fermentation*, which brings up an important subject. Intestinal fermentation is something more than an accumulation of gases in the alimentary canal, for which charcoal may be given. In every hour of our lives, but particularly during the night, there are forming constantly in the intestines, by normal processes of fermentation, soluble alkaloidal substances of a poisonous nature, which are absorbed into the portal circulation, and thus reach the liver, one of whose functions it is to destroy these poisonous products. If from any cause the liver is out of order, and so unable to destroy these poisons in the blood which passes through it, they pass on into the general circulation and give rise to very serious symptoms. More than fifteen of these poisons have been isolated, some of them resembling in their action atropine, aconite, curare, etc. Healthy urine, which contains several of these substances, is more poisonous than the urine of *Bright's disease*, for the reason that, instead of being eliminated by the kidneys, they are circulating in the patient's system. It is now known that urea is not the cause of *uræmia*, for persons with uræmic symptoms do not always show a deficiency in the amount of urea excreted; but this disease is due to the presence in the system of these deleterious substances. Many cases of nervous ailments, such as *hysteria*, functional or intermittent *headaches*, severe *neuralgias*, are unquestionably dependent on the same cause, and here the treatment should mainly be to keep the bowels open and to disinfect the intestines. So also in those forms of *epilepsy* associated with intestinal symptoms, diarrhœa or constipation either preceding or following an attack, with offensive breath, instead of giving bromide of potassium, steady attention should be paid to the disinfection of the intestines; and one of the best remedies for disinfecting the stomach is salicylate of soda, or, better still, salol.[1]

The other members of this series, some of them forming distinct classes, possess many properties in common with the substances just described, and may therefore be dealt with briefly.

Oil of Wintergreen (Oleum Gaultheriæ) was formerly regarded as an excellent tonic, and was of considerable use in the treatment of malaria, before the introduction of quinine, and of skin diseases dependent upon malarial infection. It is a very good remedy for *toothache*, as it contains a considerable quantity of salicylic acid, which has the anæsthetic properties common to the carbolic-acid series. In the treatment of *chronic dysentery* (which should always be antiseptic) oil of wintergreen is very valuable. In this disease, while something may be gained from treating the bowels topically, it is essential that the disinfection be local, as there are frequently ulcers in the rectum which, for obvious reasons, can never get well unless kept disinfected. Five or ten drops of oil of wintergreen or of oil of peppermint should be added to a quart of warm water and used as an enema to wash out the lower bowel after every movement. Frequently *diarrhœa*[2] and chronic dysentery, where the disease is near the exit, are cured in this way without the administration of any medicine.

Oil of Peppermint (Oleum menthæ piperitæ), the most active principle of which is menthol, or mint camphor, is a magnificent antiseptic, being clean, pleasant, and having the property of quickly alleviating pain. It is the best local remedy for phlegmonous irritation, and therefore should be used in the treatment of carbuncles. A paste made of **oatmeal** moistened with glycerin (or ordinary sweet oil) three parts, and oil of peppermint one part, is an excellent application for burns, as it relieves the pain very rapidly, prevents suppuration, and, unless the burns are deep-seated, obviates the formation of scars. *Oatmeal* itself is an antiseptic on account of its powerful drying properties.

Benzoin.—This substance is obtained from a resinous tree (Styrax benzoin) growing in Java and the East Indies. Its compounds, called "balsams," contain the carbolic-acid principle, and therefore possess the anæsthetic and disinfectant properties of the carbolic-acid compounds. These balsams are traditional antiseptics. They are excellent deodorizers, and therefore used with other remedies in the treatment of wounds. The pain in *bronchitis* will be much relieved by the inhalation of these substances.

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[1] For further uses of salicylic acid, salol, etc., see p. 37.

[2] For the clinical differences between diarrhœa and dysentery, see p. 159

Camphor.—Camphor is a stearoptene derived from Cinnamomum camphora, a tree growing in Malacca and other south-eastern parts of Asia, and may be made from ordinary hemp tops when in bloom. It is found also in pennyroyal and many other plants of this class which are destructive to insects and fungi. It is much more insoluble in the juices of the stomach than the balsam compounds, but more volatile, and, being an antiseptic, it is on this account specially useful in *Asiatic cholera*, *cholera infantum*, etc., because it is not dissolved in the stomach, but operates in the upper part of the intestines. Camphor has been the principal remedy for a long period in the treatment of *diarrhœa* characterized by watery discharges but unattended by pain—a most dangerous form, especially when it occurs in children. Large doses are poisonous, the symptoms being similar to those of carbolic-acid poisoning.

Naphthaline.—This substance is also a derivative of coal tar. It is a good deodorizer, and, like other members of the turpentine class, is not dissolved until the large intestine is reached. It is a very efficient remedy in the treatment of chronic dysentery (dose, gr. i.-v.).

β-Naphthol is a compound of this drug. It should be given to hysterical patients with symptoms of *intestinal fermentation* (dose, gr. v.–x.). Rhubarb and benzoate of soda are also good remedies for this complaint.

For Diarrhœa with Gout.

℞ Sodii Benzoatis	ʒ ij
β-Naphthol	ʒ ss
Salol	ʒ i

M. Div. in capsulæ No. xxiv.

Sig. Two capsules after each meal and upon going to bed at night.

Thymol.—This crystalline solid is the most important constituent of oil of thyme, a powerful antiseptic. It is sometimes substituted for salol, naphthol, naphthaline, etc., and is especially used in the treatment of various skin diseases.

Chinoline.—This is a substance found in the alkaloids of cinchona, whence its name, and it is also derived from coal tar. Used externally it possesses the antiseptic and disinfectant properties of the other compounds of this series. Internally it is used as an antipyretic, here being allied somewhat to quinine in its properties. The efforts within the last few years to make quinine artificially, though not successful, have resulted in the production of several compounds which have the power of reducing a high temperature. Among the more prominent of these compounds are **antipyrine** and **antifebrin,** but the whole carbolic-acid class possess the same property in a greater or less degree. It is questionable practice, however, to attempt to break the temperature in any kind of fever, for this reason: that the muscles, in addition to their mechanical function of producing the various movements of the body, are the chief heat-generating tissues, furnishing four-fifths of the total bodily heat; and therefore *fever* is essentially a muscular disease, and one of its first signs is muscular weakness. Now, these drugs are muscular paralyzers, and consequently their administration increases the muscular weakness, and sometimes to such an extent as to produce permanent loss of muscular strength. The application of cold as an antipyretic is therefore to be preferred, as it does not have this effect. Antipyrine and antifebrin are, however, useful in the treatment of *headaches* dependent upon intestinal fermentation, and for relieving *rheumatic pains.* They are the best remedies for the *neurotic pains* of *locomotor ataxia,* caused by some derangement of the nerve centres. When used for this purpose, ammonia or salicylic acid should be added to the antipyrine or antifebrin, a combination of drugs of similar properties being more effective than one used alone.

Chlorine Class.—The principal substances forming this class are chlorine, bromine, iodine, and their compounds. Their disinfectant properties depend upon their chemical affinity for hydrogen, which is so intense that under favorable circumstances they will decompose water in order to combine with the hydrogen. They operate, therefore, in two ways: directly, by decomposing water, and in that way destroying tissues in the same manner as lime does; indirectly, by the liberation of oxygen in the nascent state. This double action renders them, next to corrosive sublimate, the most powerful destroyers of tubercle bacilli, the action of corrosive sublimate itself as a disinfectant being in some measure due to the chlorine it contains. As antiseptic medicines they are in one respect superior to carbolic acid, as they may be taken in relatively larger doses, symptoms of poisoning never happening except when given in concentrated form.

This class is particularly useful against *gangrene* and the *specific communicable diseases*. In gangrenous decomposition, which is a different thing from the decomposition of pus, there is a particular form of bacteria which can only be dealt with by the chlorine class, the carbolic-acid class being almost powerless. Different kinds of decomposition are produced by separate organisms, and a germicide effective against one form of bacteria may be useless against another. Disinfectants of one kind are never universal, and lives have been sacrificed because of the erroneous impression that what has proved a disinfectant against certain agencies of disease must necessarily be so against others of a different character.

Chlorine.—Chlorine can be obtained by taking equal parts of common salt and black oxide of manganese. To a tablespoonful of this powder, placed in a saucer, add a tablespoonful of strong sulphuric acid diluted (with water) one-third. This will produce enough chlorine to disinfect a room thirty-two feet square. In cold weather the saucer should be heated, either by placing on the stove or over a lamp.

After the chlorine has left the above compounds, the residue, which is also a disinfectant, may be thrown into the water-closet, and this should especially be done in cases of *typhoid fever* to disinfect the stools and thus prevent them from becoming the source of infection. Chlorine, from its extreme pervasiveness, should be used in the disinfection of halls, passages, etc., in houses where any of the communicable diseases have been developed; for, while it may not destroy all the germs, it will greatly hinder their multiplication and so reduce the danger of infection.

Chlorine in the form of Labarraque's solution (which is more pleasantly borne by the stomach than the chlorinated water of the Pharmacopœia) is, when properly diluted, an admirable drink in all cases of specific communicable disease, especially when a gangrenous condition of the blood and secretions is beginning to be produced. The first indication of this is the appearance of sordes on the lips and teeth, due to the exudation of decomposing blood through the mucous membranes. Following this there will be high fever, very profound nervous prostration, rapid decomposition in intestines, which become tympanitic, and sooner or later an extremely offensive diarrhœa, and the whole body will be full of little emboli caused by the ante-mortem decomposition of fibrin. So also in *malignant dysentery* and bad cases of *diarrhœa*, not only are the discharges putrid, but the whole appearance of the patient shows him to be suffering from putrid intoxication. As soon as sordes appears, at once charge the system with as much of these disinfectants as the patient can bear. Labarraque's solution should be given in doses of never less than ʒ i., and if diluted with water or milk, so as not to be locally irritant, ʒ iv. may be given, and sometimes even ʒ vi. In all these exanthematous fevers (with the exception of typhoid), begin with the disinfection of the alimentary canal by a calomel purge, which, in the case of children, may be combined with jalap. After this has operated, the treatment should be Labarraque's solution in sweetened milk, given every two or three hours, or, in severe cases, every hour or half-hour. Where there is a very irritable condition of the stomach, it may be necessary to give paregoric to prevent vomiting.

Bromine.—This substance is extremely destructive of all forms of microscopic life, more so than chlorine, and in fact it is the most powerful disinfectant in the world; for though corrosive sublimate is more destructive, it loses its power by combining with albumen. As bromine is very volatile, it is used with chlorine to disinfect the air and those parts of a building which cannot be reached by liquid or other disinfectants. It is the remedy *par excellence* for *hospital gangrene*, and is to be given in all cases where there is gangrenous development, especially in *diphtheria*. It is not a specific against this disease, but is a disinfectant to be used against its local manifestations and to prevent the infection from spreading. As soon as there are suspicious diphtheritic signs in the throat, touch every part affected with bromine in form of Smith's solution (a solution of bromine analogous to Lugol's solution of iodine in water. Take two ounces of a saturated solution of bromide of potassium; to this add slowly, with constant shaking, one ounce of bromine; then add very slowly one ounce of water; four drops of this solution contain one drop of pure bromine), applying it very lightly with camel's-hair brush, using a new brush with every application (Smith's sol. ʒ i., aquæ ℥ i.). The strength of the application should be increased if membranes have already formed; and if they are very large and the breath fœtid, it may be necessary to apply the solution clear. Do not prevent the coming away of the membrane, and, on the other hand, do not attempt to remove it forcibly. This is very effective against the gangrenous odor, and it is successful where chlorate of potash, muriated tincture of iron, etc., fail, many of the other symptoms being also relieved. There need be no hesitation in applying the solution clear, as it is not a caustic. In the proportion of gtt. i. to water ℥ i. it may also be used as a gargle. Internally have the patient take as much bromine as possible, one drop to drachm of sweetened water or milk every hour, and the bromine may be increased to two, three, or even four drops if the symptoms do not improve. Owing to its disagreeable smell, there may be some difficulty in getting the patient to swallow the first one or two doses, but afterward there will be less objection to it than to any other disinfectant, and it does not cause vomiting and is in no way debilitating.

On account of its volatile property, and the inability to disinfect the deepest recesses of the auditory canal by solid or liquid disinfectants, bromine should be used in the treatment of otorrhœa, a difficult and often extremely dangerous complaint. A spray of one to four, to be gradually increased to equal parts, is to be used.

Sulphur.—When burned, sulphur produces an irritating gas called sulphur dioxide, which was once used very commonly to fumigate houses, holds of ships, etc. Experiments have demonstrated, however, that this gas has very little power to destroy any form of bacteria, and so for the purposes mentioned is less effective than either chlorine or bromine in form of vapor. For fumigation of hospitals, holds of ships, etc., nothing is better than **wood-smoke**, which is a combination of a number of disinfectants—charcoal, carbolic acid, acetic acid, carbonic oxide, etc.—and it certainly is to be preferred to sulphur dioxide.

The **sulphite of soda** is used against the vomiting, which is due to the growth of a fungus plant (sarcinæ ventriculi) in the stomach. The plants look like uncolored squares of a checker board. There are usually from three to six of them in a group. They are unfavorable in their significance, and are found nearly always in a low condition of the system, and notably in cancer of the stomach.

It is also useful in the distressing inflammation of the mouth and throat accompanying *phthisis*. There appear white patches, like diphtheritic membrane, due to spores of the bacilli. This condition is accompanied by great sensitiveness of the parts, and the patients are distressed by the saliva which accumulates in the mouth. In these cases use as a gargle:

℞ Sodii Sulphitis,	ʒ i.
Aquæ Menthæ Piperitæ,	℥ i.

M.

A very effective way of sometimes applying it is in the form of a powder blown into the throat:

℞ Sodii Sulphitis,	ʒ i.
Morphinæ,	gr. ss.–gr. i.

M.

Iodine.—The action and medicinal properties of iodine are very similar to those of chlorine and bromine. Internally, it is mostly used in the form of Lugol's solution,[1] a preparation which enables it to be administered without irritating the stomach.

Iodoform, one of the principal compounds of iodine, is much used as an application to surgical wounds. It is a powerful deodorizer, but as it is now conclusively proven that as a germicide iodoform is almost valueless, its undoubted antiseptic properties must depend either upon its forming new combinations on the surface of the wound, or else upon its destruction of the poisonous products of septic infection found in the tissues, which enables the latter, weakened by their presence, to more effectually resist the malign assaults of the morbific germs.

UNCLASSIFIED DISINFECTANTS.

Boracic Acid.—This is a very useful surgical disinfectant and can be used with carbolic acid in the treatment of wounds. It depends for its disinfective properties upon its remarkable drying powers, acting similarly to lime, but without its caustic and other disadvantageous properties. It may be used as follows: To boiling water add salicylic acid until a saturated solution is formed. To this add borax until no more is dissolved. Into this dip some oakum. After the oakum is dried, it will feel softer than before. When thoroughly dry, place the oakum over the wound, and over this a layer of cotton wrung out of a solution of carbolic acid, one drachm to a pint of water. This dressing will remove all odor in about twenty-four hours. As the oakum is irritating, the edges of the wound and skin should be protected by flexible collodion.

Boracic acid, not being irritating, is also very useful in the treatment of *eczema*. It is used by otologists in cases of *otorrhœa*, but has been said to cause fatal inflammation, owing to suppuration being stopped by the water of the tissues becoming absorbed. However that may be, it is a very good application, in strong solution, for mucous discharges from canals, and hence much used by gynecologists. It is soluble in twenty parts cold water, but only in three parts boiling water.

Corrosive Sublimate.—See "Disinfection of Wounds," p. 42.

Permanganate of Potash.—This is a salt forming dark-purple, slender prisms, a powerful caustic if sufficiently concentrated, non-volatile, and a rapid deodorizer. It is extremely useful for disinfecting the gangrenous odor of an *open cancer*, where a permanent or non-volatile disinfectant is desired, not, as in ordinary cases of gangrene, a volatile one such as bromine. Potassii permang. gr. x. to water ℥ i. is a strong, irritant application, but does no harm to an open gangrenous sore. It is a very good remedy, in less strength, for some cases of offensive *leucorrhœa* and other vaginal discharges. It is also particularly good in *ozæna*, in the form of a powder (Bism. Carb. ʒ i., Potassii Perm. gr. i.) and blown into the nose. In some cases it may be used in the form of vapor (in strength of gr. x. to ℥ i.), but is not so effective in this way, nor in form of Condy's Fluid, as the powder.

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[1] For formula, see Iodine, p. 112.

USES OF DISINFECTANTS IN THE TREATMENT OF DISEASE.

Disinfection of Special Diseases.

Cystitis.—Most of the inflammations of mucous membranes are due to their having been bathed for a number of hours in some putrefying liquid, and cystitis is one of the diseases resulting from this condition. Urine normally is perfectly aseptic, but if from any cause, *e.g.*, alkalinity, it decomposes before leaving the system, an inflammation of the bladder results, and there will be found mixed with the urine pus and stringy mucus. The bladder should be thoroughly washed out with a disinfectant, using either a dilute solution of *carbolic acid* to which borax may be added, a 1:10,000 solution of **corrosive sublimate,** or, better than any, **resorcin** or **quinine,** the latter preferably. (Over or rapid distention of the bladder is to be avoided, as paralysis, and consequent retention of urine, may result.) After the bladder has been washed until the water returns clear, an ounce of slightly saline water in which one grain of quinine has been dissolved should be injected and allowed to remain. On account of their disinfectant and anæsthetic properties any of the turpentine class of remedies may also be used in the disinfection of the bladder and for the relief of the pain of the inflammation, **buchu** being the best, as it is excreted freely by the kidneys and does not impart any odor to the urine. **Salol** is also an admirable remedy in chronic cystitis, as during its decomposition in the body carbolic acid is evolved, which is taken up by the blood and excreted by the kidneys. Twenty or thirty grains a day of this substance will give a dark color to the urine. **Naphthol** may also be used, but it is not so effective for this purpose as salol.

Dermatoses.—Owing to the morbid condition of the blood, and the activity of those universal microscopic agents which are ever ready to start up fermentative processes in any wound or lesion, many skin diseases are extremely difficult to heal, particularly eczema and similar diseases where the protective character of the skin has been to a greater or less extent lost. It is necessary, therefore, to treat these diseases antiseptically; and on examining prescriptions that have been used for generations in the treatment of skin affections, it will be found that the remedies have almost without exception been antiseptics, *e.g.*, mercurials, balsams, turpentines, etc. The circulation in the system of ptomaïnes, the products of intestinal fermentation, is a very common cause of these affections, and therefore not only must the disease be dealt with by external local applications, but remedies must be given internally for the intestinal fermentation.

For skin eruptions with pruritus, and for the itching of piles, **salicylic** acid may be applied as a local application. For *eczema* a solution of **salicylic acid** (one per cent, increase to two per cent if not effective, and, where scaliness is present, to five per cent), to which borax has been added, should be used as a constant wash. **Zinc ointment** may be made more effective by adding to it **salicylic acid.** **β-Naphthol** is also very effective in the treatment of skin affections, solutions being of the strength of five per cent, a solution of ten per cent causing local irritation; but in such scaly affections as psoriasis it will be necessary to use strong applications.

Boils and carbuncles (which are several boils that have run together) are external in their origin, being the result of atmospheric infection. Boils are not only contagious but auto-contagious, spreading over the patient until he is fairly covered with them, and occasioning great mischief by generating pus. The treatment should be local, by *cauterization* before the formation of the vesicle, afterward by the injection of equal parts of **carbolic acid** and **glycerin** into the centre of the boil. **Oil of peppermint** may be applied in the same way to carbuncles, the sinuses, if these exist, being also filled with the oil. Boils are the frequent accompaniment of diabetes, and there also seems to be a very curious connection between carbuncles and diabetes, patients with carbuncles frequently having sugar in their urine. These carbuncles, boils, etc., are very troublesome things to contend with in this disease, and should be dealt with as effectively and rapidly as possible, as there is danger from the burrowing of pus.

Phthisis.—Tuberculosis is a disease due to an infection of the system by one of the forms of soil bacilli, which is not self-limiting in its development, but reproduces itself in the body indefinitely. To destroy its extraordinary vitality, it would be necessary to administer antiseptics of a strength which the patient's system would be wholly unable to stand, and so against the tubercle bacillus little can be done. The fatality of phthisis, however, is due not so much to the tubercle bacillus—for this, if left to itself, would become encysted and so harmless, as shown in cases of tubercular peritonitis—but to its dangerous alliance with the *staphylococcus pyogenes aureus*, or pus-generating corpuscle, present in the ulcerative processes caused by the necessarily constant respiratory movements of the lungs when in an inflamed condition. The persistent use of medicinal antiseptics of the carbolic-acid class is therefore of benefit in the treatment of phthisis in no other way than to limit the amount of suppuration and suppurative ulceration. The lungs are very little affected by the inhalation of carbolic-acid vapor (though this may still be used for offensive breath), the internal administration of **creosote**[1] being far more effective, as it is taken up and excreted by the lungs, carbolic acid being principally eliminated by the kidneys; and, moreover, creosote is better borne than carbolic acid. It may be given in either solution or pill form, and as much as the patient can possibly take, until he becomes nauseated, which shows that the proper dose has been passed. At the commencement, six grains a day may be given, the dose being gradually increased, which becomes decidedly effective if twenty grains can be taken. Not more than one grain should be given at a time. The pill form is preferable with **bismuth** or in capsules, but creosote is better borne in liquid form, the taste being obviated by combining equal parts of syrupus zingiberis and elixir cinchona with the water. Other remedies, of course, have to be used in the treatment of phthisis, creosote being simply the chief pulmonary disinfectant.

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[1] Creosote, a product of the distillation of wood tar, is an exceedingly complex substance, many of its constituents belonging to the carbolic-acid class, and consequently, in its disinfectant and anæsthetic properties, its actions closely resemble those of carbolic acid.—ED.

Typhoid Fever.—This disease might properly be termed enteric fever, because the chief seat of its development is in the intestines, and it is a question whether intestinal infection is not the chief factor. This seems to be proved by the fact that the relapses which occur after the patient has had a normal temperature for some days, and which are so serious owing to his debilitated condition, are mainly due to the indulgence in animal food, overtaxing a weakened digestive system and giving rise to intestinal fermentation; this fermentation of digestive matter furnishing the soil for the growth of a second crop of typhoid bacilli reproduced from the first. This fever should be treated with intestinal antiseptics, one of the most effective being **bismuth**,[1] an excellent local antiseptic for any purpose. If this treatment is not adopted, diarrhœa, dependent upon putrefaction of intestinal secretions, will be a very frequent concomitant of the disease. From this it naturally follows that the matter of diet is extremely important in this and in all fevers; for whenever the body temperature is raised to a certain degree above the normal, there is an arrest of the secretions throughout

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[1] The following is the usual prescription:

℞ Bismuthi subcarbonatis, ...	gr. xl.
Pepsinæ saccharati, ...	gr. xl.
Acidi carbolici, ...	gr. i–ij.

M. Et ft. pulv. No. viii.
Sig. One every three hours.

the body, but especially those of the alimentary tract, which have antiseptic as well as digestive properties. Hence in all fevers there is a tendency to intestinal fermentation and putrefaction (whether food is taken by the patient or not) leading to diarrhœa, produced by the excessive discharge of mucus due to the intestinal irritation. This is characteristic of typhoid fever; but in all chronic fevers there is a similar tendency to a loose, watery diarrhœa of a "pea soup" kind, as it is termed, and if the fermentation, etc., is not checked there will ultimately be ulceration of Peyer's patches—a very dangerous condition if disinfectants be not used. For this reason, the use of *beef tea* in fevers, an article of diet formerly almost universally administered, has now been abandoned from its tendency to putrefy. Moreover, it possesses no nutritive power, being simply a stimulant made from the flavoring substances of meat. Milk is the only article of food that should ever be given to a typhoid-fever patient, and even here it is important to remember that in all fevers, notably in typhoid fever, the stomach is reduced to the weakness of infancy; and as an infant cannot digest milk as such, neither can a typhoid-fever patient. It must, therefore, be diluted, preferably with an antiseptic, **lime-water** serving admirably for this purpose, as lime is both a local and medicinal antiseptic. Equal quantities of milk and lime-water should be used, and frequently given to the patient in small quantities throughout the twenty-four hours. **Pepsin** may be combined with it, as it prepares the food in a natural way, and thus prevents it from remaining undigested in the stomach, and is also decidedly antiseptic, being a virulent poison against many forms of bacteria.

Wounds.—Where tissues are injured or destroyed, the skin however remaining unbroken, there will be various changes of appearance, swelling, absorption, etc ; but if the patient is in good health, the wound will rapidly heal without any fever or inflammation, no matter how extensive the laceration may be. But if the wound communicates with the open air, there will be inflammation and suppuration, traumatic fever will set in, and not uncommonly severe systemic disturbance, indicative of the absorption of some form of poison, will follow. All of these symptoms are due to the infection of the open wound by bacteria. In order to imitate nature as far as possible, surgeons now place a protective covering over these wounds, first destroying with a local antiseptic whatever atmospheric germs may have permeated the tissues. If the treatment be perfectly antiseptic, there will be no tendency to inflammation or purulent discharge, union without suppuration being the triumph of modern surgery.

Carbolic acid is the leading surgical disinfectant. This substance is not only a powerful antiseptic, but is soluble in living tissues and organic fluids, which gives it in many cases an advantage over other disinfectants. For instance, a strong solution of corrosive sublimate, a far more powerful germicide than carbolic acid, is not nearly so effective as the latter in destroying the bacilli swarming in the sputum of a phthisical patient, because it combines with the albuminous constituents of the sputum (to form an albuminate of mercury), which carbolic acid does not. Although very soluble in oil, carbolic acid is more effective in a watery solution, and hence the use of carbolized oil has now been abandoned. All forms of bacteria may easily be destroyed by comparatively weak solutions of carbolic acid or corrosive sublimate. The destruction of the spores of bacteria is unfortunately not so easily effected, as they possess an amazing vitality, far greater than that of the bacteria. If, however, the bacteria be destroyed in sufficient number, the production of spores will be diminished, but the fact that there are spores will necessitate the continuance of disinfective measures in the hope of lessening their chances of growth.

For an open wound, the strength of the solution of carbolic acid (which should always be in water, not in oil or alcohol) should be from one in forty to one in twenty, the latter strength preventing the multiplication of spores for two or three days. After the wound has been cleansed with the solution, apply the coverings as follows: (1) a protective covering of oiled silk, covered with a coat of varnish made of dextrin, starch, glycerin, etc., to render it impermeable to carbolic acid and as an additional antiseptic, and around the edges of the covering a cream of salicylic acid and glycerin may be applied; (2) layer upon layer of antiseptic gauze, *i.e.*, gauze which has been saturated with carbolic acid, to which may be added salicylic acid and borax; (3) an india-rubber cloth; (4) a cloth dipped in a solution of one drachm of carbolic acid in a pint of water. If these precautions are taken, and the surgeon's hands, instruments, etc., thoroughly disinfected, the mortality from surgical operations will be very small. The strong smell of carbolic acid, which is disagreeable to some persons, may be removed by adding to it oil of cinnamon or oil of wintergreen.

Next to carbolic acid, **corrosive sublimate** is the only substance to be recommended for surgical disinfection. In preventing the initial infection of a wound, corrosive sublimate is more powerful than carbolic acid, and therefore is to be preferred as a first application in cases where, from exposure of the wound, germs are present in great numbers, and notably where the wound or surface is within a cavity, as in abdominal operations. As a continuous application it is not to be recommended, as it may cause death by poisoning. The strength of the solutions should vary with the size of the wound; the larger the wound the less the strength, because of the danger of poisoning by absorption. The strongest solution for any wound at commencement should only be 1:10,000, and for a wound with a large surface the strength should be less. A solution of 1:40,000 is quite sufficient to destroy, not the spores, but everything in the shape of bacteria themselves.

PART II.

MEDICINAL REMEDIES.

MEDICINAL REMEDIES.

A medicine is a remedy which cannot act until it has entered the circulation in a state of solution. By circulation is meant not only that of the fluids contained in the blood-vessels and lymphatics, but the extra-vascular or *interstitial* circulation. The latter circulation, which is supplied by the exudation of the plasma of the blood and ultimately enters the lymphatic system, is a most important factor in the processes of nutrition and molecular interchange, and is the most important of all the circulations. That it is in nearly as rapid movement as the blood itself is shown by the quick diffusion of hypodermatic injections. Many remedies which seem to be medicines are not so, from being used in a non-medicinal way. Thus nitric acid, given as a tonic to improve the appetite and aid digestion, acts as a medicine; applied externally as a caustic, its action no more resembles that of a medicine than that of the actual cautery. By a medicine, therefore, we mean that we have a remedy that has become part either of the blood or interstitial fluid, and is acting in a molecular way either upon the secretive processes of nutrition or upon some function of the nervous system; and, therefore, such remedies as cold, heat, counter-irritants, blisters, caustics, electricity, baths, massage, etc., which act without entering the circulation, are not medicines.

It is of the first importance in giving a medicine to get it as soon as possible into the blood or interstitial circulation, so as to have it dissolved (if this has not been done before administration) and carried all over the body. Hence a medicine does not act locally, as it becomes a part of the general system as soon as it enters the circulation.

The principal avenues for introducing medicines into the circulation are: (*a*) various portions of the alimentary canal; (*b*) the skin; (*c*) the respiratory passages; (*d*) the subcutaneous areolar tissue. Of these the alimentary canal is the avenue most commonly chosen, but is inferior in many respects to that of the subcutaneous areolar tissue by hypodermatic injection, a method which unfortunately cannot always be used.

(*a*) VARIOUS PORTIONS OF THE ALIMENTARY CANAL.

1. *The Mouth.*—That absorption may take place from this portion of the alimentary canal, if soluble substances are held in contact with the mucous membrane long enough, is proved by the fact that drugs used as gargles may sometimes be detected in the urine and other secretions. Croton oil, placed on the tongue of a comatose person, produces purgation with almost as much certainty as if introduced into the stomach. Permanent discoloration of the skin of the face has been produced by merely applying nitrate of silver to the throat continuously for two months. This method of administering medicines is now rarely used, except in those cases where deglutition is totally suspended.

2. *The Stomach and Small Intestine.*—Medicines, generally, are introduced into the stomach, as this is the most available and surest way. There are certain points to be remembered in giving medicines which are to be absorbed by the stomach or acted on by its secretions. One is, that the alimentary canal has various secretions which are never called into action simultaneously, but successively; another, that digestion and absorption are two distinct processes, and absorption never takes place to any extent while digestion is active. Non-nutrient medicines, especially of the neurotic class, lose a great deal of their efficacy in passing through the alimentary canal, from their modification by the remarkable solvent process of the digestive secretions. Therefore, all medicines which the alimentary canal does not immediately absorb that are of vegetable origin, especially those whose active principles are alkaloids,[1] should always be given

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[1] An alkaloid is a definite chemical substance of organic origin, alkaline in reaction, and called an alkaloid because it resembles an alkali in chemistry,

when the digestive processes are least active, or else administered by the rectum, otherwise they will be so changed as to be no longer capable of producing the same action as when introduced directly into the interstitial circulation. On the other hand, certain medicines of the restorative class should be given an hour or two after a meal, as they are to be digested in the intestines. An important fact to be considered in this connection is, that whatever is absorbed from the alimentary canal, passes into the portal system and is filtered through the liver, before it enters the general circulation. If, therefore, the liver is embarrassed in its functions, medicines given by the alimentary canal will be delayed in their action, and there will also be great loss. Hence in hot climates, where the portal circulation is generally slow, larger doses have to be given than in climates where this circulation is more active; and in all cases where medicines are to be given by this channel, it is very important that this circulation shall be in its normal state of activity. For example, a sharp, purgative dose of calomel given before the administration of quinine will often enable the latter to operate successfully, where double the amount had previously been given without any effect; for quinine, if subjected to long delay in the alimentary canal, being an alkaloid, is very easily altered in its composition. (The quinine should not be given till after the movement has occurred.) Attention to this fact is still more important if there is *gastritis* dependent on the hepatic engorgement. In *remittent fever* of malarial origin, if there is vomiting and tenderness over the stomach, even large doses of quinine, given by the mouth, are markedly inefficacious until the gastric irritability has been allayed. For the same reason, if there is liver disease, the treatment of *dropsy* by diuretics frequently fails, the presence of fluid in the abdomen hindering still further the operation of these remedies. There-

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in that it is capable of combining with acids to form salts. Unlike an alkali, however, the salts so formed have the same physiological and therapeutic action as the alkaloid itself. The preparations of the drugs from which the alkaloids are obtained may vary in strength, but not the alkaloids themselves, which are always of the same strength, and hence are said to be definite.

fore, in this condition, an ointment of mercury and digitalis, rubbed in through the skin to cause purgation, should first be used, and the diuretic administered after it has acted. The unsuccessful treatment of *chlorotic* women by the exhibition of iron furnishes another example. Iron is the remedy to be given; but where the intestinal and liver secretions are all in abeyance, the iron is not absorbed, and consequently there is no beneficial result. Very often this suspension of the secretions is caused by persistent irritation of the ovarian plexus, and when this has been overcome,[1] and cathartics are given once or twice a week, the administration of iron will be successful. These examples have been given, to emphasize the necessity of ascertaining the powers and limitations of the alimentary canal, before choosing it as an avenue for administering medicines.

3. *The Rectum.*—Under certain conditions it becomes necessary to administer medicines "per rectum" in the form of enemata. The following precautions are to be observed: (1) if there is portal congestion, it must be relieved before the administration of the enema, as it hinders absorption; (2) the enema must be in a state of solution, as there are no digestive secretions in the rectum, hence cod-liver oil (unless in a state of fine emulsification) and iron are not to be given; (3) the enema must not be a local irritant; (4) neither should it be an astringent, as, if it is, it will not be absorbed, therefore tannin and some of the salts of iron are not to be given; (5) as a vehicle pure water is to be preferred, starchy liquids impeding absorption and necessitating a much larger dose of the medicine than when given by the mouth; (6) the smaller the quantity the better: not more than a fluidounce should ever be given at one time, as over-distention excites the peristaltic and expulsive action of the rectum.

When the rectum is available, enemata are used: (1) where it is desirable to spare the stomach on account of its exceedingly irritable condition, as in gastritis; (2) for the administration of nourishment, where, owing to disease or other causes, the ordinary channels cannot be used; in these cases peptonized milk, and beef-tea and white of egg that have been dissolved in milk, and peptones should be given; (3) where only the local action of a medicine is desired. The benefits of this local action are that in giving medicine by the rectum, we have surer and better effects upon pelvic diseases. Thus in irritable *stricture of the urethra,* where a catheter cannot be passed, aconite given by the mouth will fail to give any relief, but if given by the rectum a catheter may be passed almost at once. So also in all cases of severe *dysmenorrhœa, cystitis,* etc., rectal medication is to be preferred, as it does not occasion any constitutional disturbance and gives relief. Suppositories may be used instead of liquid medicines, and, as these dissolve slowly, larger doses may be given. Thus in solution only one-quarter grain of ext. belladonna can be given; in form of suppository we may give one grain.

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[1] See Constipation, p. 231.

(*b*) THE SKIN.

Medicines in aqueous or alcoholic solutions are absorbed by the skin, only in very minute quantities and with great difficulty. If, however, fats or oily matters, in the form of ointments or liniments, are used as vehicles, medicines can very readily be introduced into the system, especially if their absorption is assisted by friction. This method is of special use: (*a*) in inflammatory conditions of fibrous structures capable of being reached through the skin; (*b*) where the deeper layers of the skin itself are involved, as in *syphilitic* diseases of the skin; (*c*) in *rheumatic* inflammations, where the sheaths of muscles surrounding joints, have a tendency to thicken; (*d*) for the treatment of *enlarged lymphatic glands;* (*e*) for the treatment of *epididymitis* which is causing thickening of affected tissues; (*f*) for *diseases of spinal cord,* dependent upon local inflammation; (*g*) for the vascular thickening and inflammation following *sunstroke;* in cases of this kind, and for diseases of the spinal cord where this method is to be used, the oleates, ointments, etc., must be rubbed in along the spinal cord, which can also be reached through the great nerves; (*h*) constitutional *syphilis.* In treating this latter disease by inunction, the

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skin should be thoroughly washed. to secure easy absorption, and the ointment should be applied to different parts of the body, instead of confining it to one place. This treatment has been very successful in some of the most obstinate cases, where the patients had been taking mercury by the mouth, for years, without avail.

Vapors of all kinds are very readily absorbed through the skin. The quickest way to bring a patient under the influence of mercury, is by means of the mercurial vapor bath. A volatile ingredient in a liniment or ointment will aid the absorption of the other ingredients.

(*c*) Respiratory Passages.

Medicinal agents are taken into the circulation, from the mucous membrane of the respiratory tract, when given in the form of medicated watery vapor, as in sprays; in powders by insufflation, and by absorption of gases and vapors, such as ether, chloroform, etc., by the lungs.

(*d*) Subcutaneous Areolar Tissue.

Medicines are introduced into the interstitial circulation direct, either by means of a hypodermatic syringe and needle, or, if these instruments are not available, by raising the cuticle by means of a blister and applying the remedy to the raw surface, as it is readily absorbed by the lymphatics of the skin. The substances used must be perfectly soluble, and, if possible, not locally irritant. Quinine, unfortunately, causes local irritation which frequently ends in troublesome abscesses. Various attempts have been made to avoid this by modifying the preparations, but so far without success. Six to eight grains of quinine given by this method produce as much effect as thirty given by the mouth. The advantages of hypodermatic medication are: (1) The smallness of the dose necessary, it being one-fourth of that given by the mouth. (2) Certainty of action, as nothing of the drug is lost before entering the circulation, and therefore we know exactly how much will actually operate. (3) Rapidity of effect. Instead of waiting for the process of absorption to be completed, we have an almost instantaneous effect, the medicine being all over the body in less than twenty seconds. (4) Localized action. This method enables us to use drugs for local purposes and to limit their action, as with cocaine, where only a limited anæsthesia is required.

In a few instances, a drug given hypodermatically produces results different from those following its administration by the mouth. Thus, with morphine, for example, the abandonment of the use of the drug by a patient who has been accustomed to take even large doses by the mouth is not followed by any ill results. There will be an intense craving for the drug, but the constitution is uninjured, and there is no intestinal disturbance. If, however, the drug has been given hypodermatically for any length of time, the cessation of its use is followed by an uncontrollable diarrhœa which in some cases has ended fatally. (Dose of drugs given hypodermatically, one-fourth of that given by mouth, to be increased as the patient becomes habituated to its use.)

Medicines are divided into two classes :[1] I. Organic or Disease Medicines. II. Functional or Symptom Medicines.

I.—ORGANIC OR DISEASE MEDICINES.

These are medicines which act upon and modify the tissues or fluids of the body, so that after their action the system is not in the same state that it was before their administration. They may be divided into : (1) Restoratives ; (2) Alteratives.

The Restorative medicines are :

1. Cod-liver oil.
2. Iron.
3. Phosphorus.
4. Quinine.
5. Vegetable bitters.
6. Mineral acids.
7. Alkalies.
8. Mineral waters.

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[1] For the distinctions in character of these two classes, see Classification of Medicines, p. 1.

CLASS I.—ORGANIC OR DISEASE MEDICINES.

Division I.—Restoratives.

General Character.—Restoratives are medicines which are natural to the system, either because they are themselves ingredients of the body or analogous thereto. They act by supplying some deficiency in the system, and are therefore of the nature of foods. Hence they are most beneficial where there exists some form of starvation, and correspond to an extremely common condition of the system, characteristic of all morbid states, viz., deficiency of nutrition due to mal- or non-assimilation. This is particularly the case in fevers, and many of the symptoms of typhoid and other fevers will be explained by remembering that the patient is suffering from want of food. How to feed the patient is a greater problem than almost anything else, and the same question arises in other morbid conditions. Moreover, it is necessary that the restorative medicine shall correspond to the deficiency in the system. There are cases in which, a particular source of food failing, there is a corresponding deficiency in the power to do a certain kind of work. Hence if, for example, the loss be that of muscular power, iron is indicated; if it be that of nervous power, cod-liver oil, phosphorus, etc., are indicated. Lastly, these medicines must not be dealt with as if they were drugs. To be efficacious they must be appropriated by the system; for whenever these medicines do good, it is because the patient needs something corresponding to them, and which he does not have in his system from some failure of the nutritive processes.

I. **Cod-liver Oil** (Oleum Morrhuæ).

Cod-liver oil is obtained from the fresh liver of the cod, Gadus morrhua. In the hepatic cells of the cod it is limpid and very fluid, resembling an ether. As prepared it should have a pale yellow color, slight fishy odor, and should develop, on the addition of sulphuric acid, a violet color passing quickly to a yellowish or brownish red.

Oil is a necessary ingredient of food, for if animals are deprived of it, ulcerative degeneration results from imperfect nutrition of the tissues. Oil is also a great source of power or force, its main function in the system being to furnish energy. Bulk for bulk, it furnishes more force than any other article of food. Accordingly, we find that fat is stored up in the cells of all tissues which have to do a great deal of work. In the more inorganic tissues, such as cartilage, not much fat is stored up; but where, as in embryonic tissue, the cells are actively engaged in the processes of growth, a very large supply of fat is needed and supplied. Muscle cells require more fat than secretory cells, and nerve cells more than muscle cells. Proportionately, there is more fat in nerve tissue than in all the other tissues put together. Fat does not enter into the formation of new tissue, except abnormally, when the process is called "fatty degeneration." The power generated from oil is used according to function, and, the highest function of all being that of the nerve tissue, we should *à priori* come to the conclusion that where its nutrition is defective, something of a fatty nature is required rather than albuminous or other forms of food.

The operations of the nervous system are vastly more complex than those of all the other tissues put together. For example, contraction and relaxation complete the functions of muscular fibres. Not so with nerve cells. All the different functions of the body, special senses, etc., are presided over and carried on by them. There is no part of the body without its corresponding nerve ganglion. All the rest of the system is merely accessory or subsidiary to the nervous system, which therefore uses the most food and requires the greatest amount of fat. But fat is not easily digested or assimilated. It is emulsified in the digestive tract only after great difficulty, and even then is not ready to be used. It must be sent to the liver before it can be assimilated by the system, as this organ has more to do with the conversion of fat into blood food than any other. Warm-blooded animals use up fat quickly, but fishes that live in deep, cold water are supplied with a reservoir of fat, as it were, in their liver cells. On examining this oil we find it to differ from that found anywhere else, in that it flows like water, is readily diffusible through animal membranes, and, when subject to capillary attraction, rises higher than any other oil. It is elaborated fat, digested and ready for use, and this at once explains its valuable properties. This fat is the best and most digestible of all foods. If albumen in its simplest form—*i.e.*, white of egg—be injected into the blood, it will at once be sent to the kidneys and excreted as a foreign substance, because, not having been prepared by the liver, the system cannot use it. So with fats. The great problem in giving them is how to get them digested, and the same question arises with the other medicines of this class, *e.g.*, iron, which, often given in a very routine way, is extremely difficult of digestion, and unless assimilated is not only absolutely useless, but will tend to irritate the patient.

Cod-liver oil was first discovered to be a ready-made food empirically. In 1754, Dr. Percival wrote a book on the uses of cod-liver oil in the treatment of rheumatism. He had lived in seaport towns where there were a large number of whalers and fishermen, and found that for generations they had been accustomed to use cod-liver oil in the treatment of rheumatism—a complaint which, owing to their occupation, is very common among them. They knew it softened leather and concluded it would soften stiff joints and act in a similar way internally. To this day cod-liver oil is the best remedy for chronic rheumatism. In 1829, a treatise was published showing that cod-liver oil was good for skin diseases of rheumatic origin, but it was not till 1843 that it was first used in the treatment of phthisis. We now know that it is the remedy of all remedies to give in diseases of the nervous system, and is the great preventive of a number of serious diseases, and finally it can be given for many conditions not supposed possible when confined to empiricism. What does it do when it acts beneficially? In 1848 and 1849, it was noted by Simon that, after giving cod-liver oil beneficially, the most notable result was the engorgement of the blood with red corpuscles. This is a fact, as it is better than iron or any other known medicine for this purpose whenever it acts in this way—in other words, when specially needed. Diseases that result in anæmia will show better results with cod-liver oil than with anything else. Iron also relieves anæmia, but cod-liver oil produces double the effects of iron, and it should always be given in febrile diseases, and in many cases of debility where there is no fever. Red corpuscles are living cells of very rapid growth and decay. It may be said advisedly that we do not know where they come from, as such a highly organized substance cannot come from the many different sources given by physiologists. Not a single function of the body would get on for an instant without them, except perhaps the hair and nails. There is this fact about them that is a mystery, viz., their rapid destruction, although so necessary to the system. In a healthy man there are about 5,200,000 of them in a space no larger than a pin's point. A single night of nervous strain will reduce them to less than 1,500,000. Hence the pale countenance produced by anxiety. Consequently the question may arise as to whether the increase of red blood-corpuscles, resulting from the administration of restorative medicines, is real or apparent only. Has there been an actual increase of red corpuscles, or merely prevention of their destruction? Corrosive sublimate and arsenic act apparently in the same way as cod-liver oil, for the blood of a healthy person to whom either of the two former drugs has been administered for a week will be found to be richer in red corpuscles. Corrosive sublimate and arsenic, however, operate by preventing or delaying the destruction of the corpuscles by rendering them more unsusceptible to the influence of the nervous system, and the persistent use of these drugs will lead to the suspension of those normal processes of the liver, owing to its fatty degeneration, which destroy, in common with other organs, the red corpuscles of the blood. Cod-liver oil and iron, on the other hand, increase the formation of red corpuscles.

The tissues of the body which suffer most from defective nutrition and which are most benefited by the administration of cod-liver oil are (1) nervous tissue, owing to its incessant and varied activity; (2) growing tissue, which needs more fat than tissue which is not growing; and (3) active tissue of any sort, muscular or secretory.

The processes of decay and death are constantly going on in the body, so much so that life has been defined as the sum total of the forces which resist death. But there are certain constitutional changes characteristic of different periods of life. Old age, for instance, is a true disease. If the body be examined carefully for all changes from the normal, there will be found certain degenerations characteristic of declining vitality, which resemble in most of their important features those found in the body of a man who has died prematurely from the excessive use of alcohol. Special diseases belong to changes of constitution at middle life and at other periods. The greatest fatality is in the first year of life, and the next greatest from the end of the first year to the commencement of the sixth. This relation of disease in children to a particular time of life, is one of the most important of all the subjects of therapeutics, for it indicates that many diseases of children are dependent upon conditions they cannot escape.

1. *The Uses of Cod-liver Oil in Diseases of Children.*—It has already been stated that the liability to disease and death is very great in the quinquennial of life between the cessation of lactation and the end of the sixth year. In the first year of life, which has the greatest fatality of any year, the deaths are mainly due to difficulties of digestion. In the five years that follow, there are many special diseases, that are the direct result of the extremely rapid growth of the human brain during this period, which is paralleled nowhere else in the system, except by the growth of the pregnant uterus. The growth is not only in bulk but in function, so much so that the nervous system of a child has proportionately a greater strain upon it than that of an adult, and moreover responds to it. In learning languages, in the acquisition of new ideas, in the formation of conceptions, judgments, etc., the child's brain does better work than it ever will at any subsequent period. This rapid growth of the brain, which at the end of the sixth year has almost attained its full weight for the rest of life, is the cause of a great many disasters. The reason is that this organ, even in adult life demands, one-fourth of the blood of the body, but in childhood one-third is required. Consequently the rest of the system must wait until the nervous system is supplied; for in experiments upon animals it was found that the last tissue to suffer from the effects of starvation, was that of the nervous system, the disappearance of

adipose tissue taking place first, followed by the bones, cartilage, epithelial and connective-tissue structures, and to a less extent the muscular system losing both in volume and weight. Hence it is that, from inability to supply the necessary amount of nutritive material, there are thousands of children that cannot survive this critical period of life. The indications of failure of nutrition in children assume many different forms, but they can all be traced to the fact that the affected tissues are not fed because the nervous system is taking so much. If enough nutriment be supplied to more than satisfy the latter, these ill effects will mostly disappear. By acting on these principles, many a child may be saved from scrofula, etc., and perhaps death. Scrofula is a disease characterized to the ordinary observation by inflammation and frequently ulceration of the lymphatic glands, with a tendency to disease of bones, chronic catarrh of mucous membranes, enlarged tonsils, excessive nervousness, otorrhœa, etc.

All these symptoms can be explained by the fact that the richer tissues are being fed at the expense of the poorer, *i.e.*, the more non-vascular, such as cartilage, etc. It is to the latter, therefore, that we must look for the first indication of defective nutrition. Hence the cornea, composed mainly of cartilage, is early affected, a little ulcer forming in the centre of a fan-shaped enlargement of veins. If the hair be examined, it will be found very flaccid and easily breakable, most of the cylinders being very slender. The next to suffer is the skin, which, instead of being smooth and soft, as a child's skin should be, has the roughness of that of an adult, notably so on the legs and chest. It may be laid down, therefore, as a rule that, unless caused by acute disease, a rough, harsh skin predisposes to mucous catarrh, a case of bronchitis rarely occurring without it. Now comes this fact: wherever mucous membranes inflame and ulceration occurs, the inflammatory irritation is immediately communicated to the nearest lymphatic glands, resulting in the disease known as *adenitis*—an inflammation of the lymphatic glands that is the necessary result, and always in the track, of an ulcer. Hence inflammation of the urethra or vagina enlarges or inflames the inguinal glands. Scrofula, however, does not immediately tend to adenitis, but to ulceration of the skin and mucous membranes, and so many of these scrofulous children have sores upon the scalp, especially in the second and third years of life. Let this condition go on unchecked, and, the system being necessarily open to many infections from without, the child in a few years will probably succumb to tuberculosis. Scrofula is not an infection in itself; tuberculosis is. The former is a negative disease, dependent upon failure of nutrition; the latter is positive, dependent upon specific infection from without. But this failure of nutrition in scrofula predisposes to tuberculosis.

The diseases resulting from a scrofulous diathesis may be averted by properly feeding the child, the food being that which nature has indicated. The singular liking of most children for cod-liver oil is an indication that it satisfies an instinctive craving for that form of food—a craving which will cease as soon as the condition which gives rise to it passes away. Therefore cod-liver oil is to be given to prevent ulcerative diseases of the eyes, ears, nose, and throat, the cuticle, and especially the scalp; the tendency to asthma, etc., on account of weakened mucous membranes, including that of the nose; convulsive diseases like epilepsy: and, in the great proportion of cases, tuberculosis.

2. *The Uses of Cod-liver Oil in Rheumatism.*—Cod-liver oil is not of much use in the treatment of acute articular rheumatism, but does a great deal of good in the chronic form, probably by increasing the nutrition of the skin; for, though the statement may not be found elsewhere, rheumatism is essentially a skin disease. This view is based upon the climatological fact that chronic rheumatism prevails most in those countries where the skin, after being covered with moisture, is subsequently chilled. Hence in wet countries like Norway and Sweden, the north of Scotland, etc., where fishing is the principal industry, rheumatism is very common; and, strange as it may seem, it also prevails extensively in very dry climates, provided they are very hot, such as the deserts of Sahara and Arabia. The explanation of this paradoxical fact, is that in these deserts the days are very hot, and, owing to the absence of all vegetation, the radiation of heat during the night is very rapid, and hence, unless proper precau-

tions are taken, the skin will be covered with perspiration during the night, and, the person becoming chilled in the early morning, rheumatism results. Therefore, for the successful treatment of rheumatism, particular attention should be paid to the skin, which is often extremely sensitive. Cod-liver oil diminishes this sensitiveness and relieves the rheumatism, and it is the best remedy for rheumatic constitutions.

3. *The Uses of Cod-liver Oil in Nervous Diseases.*—The administration of cod-liver oil in neurotic affections, by giving the nervous system a better supply of force-producing material, lessens the liability to nervous derangement, and so it should be classed as one of the greatest remedies for nervous diseases. It does not act as a specific, but, by increasing the strength of the patient, it enables him to contend more successfully with his morbid tendency. True nervous diseases, such as epilepsy, and notably those that are hereditary, such as neuralgia, megrim, etc., may be very successfully treated by combining with other remedies, such as bromide of potassium, etc., as much cod-liver oil as the patient will take. Very little permanent good will be done in the treatment of epilepsy, unless cod-liver oil be administered. Where this has been taken regularly and the attacks staved off for a couple of years, hopes may be given to the patient that he will not be troubled any more by them.

4. *In Kidney Diseases.*—Diabetes mellitus is a disease in some way related to the neuroses, for glycosuria will often follow severe nervous shocks and strain, epileptic fits, concussion of the brain, etc. Opium is not a remedy for this disease, any more than stramonium is for asthma. It diminishes for a short time the amount of sugar secreted, and so does good so far as it goes, but the dose has to be continually increased, and the disease itself is never really touched. Many cases of diabetes mellitus have recovered, but in every instance it has been where cod-liver oil has been administered; and therefore this remedy, which acts simply as a food, not as a specific, should never be omitted in the treatment of this disease. It may be also given in the chronic stages of Bright's disease where there is anæmia, but not if there are any symptoms of gastritis, because the oil will then be digested with difficulty.

5. *In Pulmonary Diseases.*—Cod-liver oil is frequently spoken of, as if it were a cure for phthisis. It is nothing of the sort. It has no power over the tubercle bacilli, either to diminish their number or to prevent their development; and, when given in the treatment of this disease, simply facilitates expectoration (a property it possesses in common with other oils) and keeps up the nutrition of the patient. But these properties render the medicine by far the most important remedy to be given in consumption, for, by keeping up the patient's strength in a wasting disease, he is better enabled to prolong the battle with his dread enemy. Cod-liver oil will prolong the life so much in these cases that Dr. Williams, of London, England, than whom no greater authority upon this subject has ever lived, has stated that whereas forty years ago the average duration of life, after the symptoms of the disease had been developed, was only twenty-two months, it is now eight years. This statement was not based upon results obtained in a few isolated cases. During a period of forty years, he kept a record of his cases and the effect of treatment. When they had reached the number of twelve thousand, he divided them into periods of ten years each, with the duration of life in the first, second, third, and fourth decades. In the first decade, where no cod-liver oil was used, the average duration of life was twenty-two months from the beginning of the disease, while in the last decade the duration was prolonged eight and a half years. His record of treatment showed that this increase in time was mainly due to the use of cod-liver oil.

Its action in phthisis illustrates the advantages to be obtained from the use of cod-liver oil, in all diseases where there is suppuration, as diseases of bone, ulcers, etc., as this valuable food supplies the deficiency caused by the discharge of much pus, the patient, as a rule, being able to bear the oil very well.

6. *In Skin Diseases.*—Cod-liver oil may be beneficially administered, in the treatment of skin diseases of a scaly nature, such as eczema, etc., where these are not dependent upon toxæmia.

7. *In Fevers.*—It is extremely difficult to obtain good results from the administration of cod-liver oil in fevers, because, as soon as the temperature of the blood is raised, the digestive and

other secretions are suspended, and so digestion is hindered. If, therefore, the temperature rises above 100° F., cod-liver oil should not be given. The temperature must be lowered first, otherwise the oil will not be digested, and distress is added to the very part that should be in the best possible condition in this disease. When the temperature is 100° F., it may be given, provided the stomach has other forms of food besides oil in it.

ADMINISTRATION OF COD-LIVER OIL.

The rule is that it should always be given from one-half to three-quarters of an hour after meals, as at that time the stomachal digestion is at its height and the food is passing into the intestines. Its digestion may be aided and the stomach rendered tolerant, by administering just before the oil a little vegetable acid, particularly lemon juice. A more common and also better combination is bismuth and pepsin, which prevents intestinal fermentation. If the patient complains that he tastes the oil an hour or two after taking it, it is best to discontinue its use, for the resentments of the stomach are incurable.

SUMMARY OF THE USES OF COD-LIVER OIL.

1. The function of fat in the economy is to produce force, and it is therefore demanded by the tissues in direct proportion to their activity, which is (1) nervous, (2) growing, (3) muscular, (4) glandular, (5) mechanical.
2. As a nerve food in early childhood, and as a prophylactic against ulcerative diseases of the eyes and ears, asthma due to weakened mucous membranes, convulsive diseases, and in many cases tuberculosis.
3. Combined with other remedies for the treatment of true nervous diseases, such as epilepsy, neuralgia, megrim, etc., notably so if hereditary.
4. For chronic rheumatism, essentially a skin disease.
5. For diabetes mellitus and chronic forms of Bright's disease, where there is anæmia but no gastritis.
6. For phthisis, to facilitate cough and sustain strength.
7. For skin diseases of a scaly nature, not dependent upon toxæmia.

8. For fevers where the temperature is not above 100° F.
9. For all diseases where there is suppuration.

II. Iron (Ferrum).

Iron is an essential element of the red blood-corpuscles and is found in variable quantities in the various articles of ordinary diet.

As cod-liver oil is the great food of the nervous system, iron is the great respiratory food. It is found normally in the red blood-corpuscles exclusively. It has only one function, viz., to be the *carrier of oxygen* to the tissues.

"Without iron in the blood we could not breathe." All the active tissues and organs consume a certain amount of oxygen in the discharge of their functions, but the muscular system is especially dependent upon oxygenation for its activity.

The muscular tissues are the moving apparatus of bodily mechanism in all its forms, and therefore carry on breathing. But muscular tissues also carry on the circulation; the nervous system can regulate the circulation, but without the former the latter could not act at all.

All the circulation, arterial, venous, and lymphatic, is dependent upon the amount of muscular power supplied by the heart, arteries, arterioles, and veins.

Where it fails and congestion occurs, it is due to the fact of the failure of part of the muscular apparatus.

In the same way the entire alimentary canal is a muscular organ. Secretion is not dependent on oxygen, but muscular movement is, and without the latter, secretions would come to a perfect standstill.

The great respiratory tract has a prodigious muscular apparatus, having bronchial tubes which keep up their work incessantly. Many a case of chronic bronchitis, therefore, is better treated by iron than by expectorants; the trouble is the inability of the muscles, from weakness, to keep the bronchial tract clear.

Iron is the remedy because all through nature muscular power depends upon the activity of breathing.

Muscular power, therefore, is in direct proportion to the efficiency of the respirations. Thus, those persons who live in the country and pass most of their time out of doors, other things being equal, are much more muscular than those leading an indoor and sedentary life.

Birds, whose respiratory apparatus is remarkably active, are far more powerful in proportion to their size than mammals, and insects breathing through every pore of their body have a muscular power that is marvellous.

It has been calculated by Prof. Huxley that if a man possessed the proportionate muscular power of a flea, he would be able to lift such an enormous building as the Newgate Prison of London.

Oxygen is the motor power of the muscles. Of all the muscular work done by the body, four-fifths is done by the involuntary muscles (owing to their unresting functional work), and only one-fifth by the voluntary. Respiration, however, and its influence on muscular action, are in direct ratio to the amount of oxygen taken in the lungs.

The difference in muscular development between man and woman, in highly civilized communities, is explained on the same principle. Therefore a frequent cause of constipation in women, is due to the fact that they are almost constantly in the sitting posture, when the respiratory activity is one-third less than when standing or moving about, resulting in a condition of great muscular weakness.

In races whose mode of life is more primitive, this difference between the sexes is far less marked. Parturition in these women is easy, and uterine diseases due to muscular weakness almost unknown.

Therefore increase respiration. There is more success in the treatment of uterine ailments in this way than by any other measures.

In all disorders due to this cause, the first indication is pure air. This having been accomplished, iron should be exhibited in order to increase the number of red blood-corpuscles and their capacity to take up oxygen, so that the system may be benefited by the pure air.

USES OF IRON.

As a Restorative.—Iron is indicated in certain forms of anæmia, and contra-indicated in others. Iron should not be given in conditions of anæmia with fever, nor where the anæmia is due to some malignant disease, such as cancer, Addison's disease, etc., nor where there is a tendency to hæmorrhages.

But for anæmia without fever, as in *chlorosis,* it is *the* specific; it is also indicated in forms of anæmia due to starvation, *i.e.,* imperfect digestive powers.

One of the commonest forms occurs in women, from their very sedentary habits; they will pass weeks at a time taking insufficient meals. In these cases iron should be given; also in all forms of blood poisoning that have a tendency to produce disintegration of the blood, such as *malaria,* where there is a tendency to a dissolution of the red blood-corpuscles with liberation of their hæmoglobin; in *Bright's disease,* because the urea dissolves the red blood-corpuscles also; and in *jaundice,* where the elements of the bile have the same tendency, causing bleeding at the gums, and ecchymotic spots on various parts of the body, due to the liberation of hæmoglobin from the red blood-corpuscles.

The best preparation to give in these cases is the tincture of the perchloride, or muriate tincture of iron.

Apart from its restorative properties, it is a decided diuretic from the presence of chloric ether, produced by the action of the hydrochloric acid on the alcohol.

In *Bright's disease,* alcohol is contra-indicated, both on account of the condition of the kidneys and the gastritis which is almost always present, so that the infusions of the vegetable bitters should be used in place of the tinctures.

If vomiting is present, iron should be given in the form of pills, composed of the carbonate, combined with bismuth, the action being very beneficial upon the mucous membrane of the stomach.

Jaundice shows that there is more or less cholæmia, and that destruction of the red blood-corpuscles is going on. Iron should be given for the same reasons as in Bright's disease, provided there is no fever.

Various forms of *neuralgia*, and especially those of the intermittent variety, are associated with, if not dependent upon, an anæmic condition due to derangement of the spleen and liver. In these cases iron is of decided value.

In speaking of anæmia as an indication for the use of iron, that form characterized by paleness or loss of color is intended, and not those forms that are due to deficiency of some other constituent of the blood, as fat, phosphorus, etc.

Chlorosis is a form of starvation which occurs in girls and young women, from arrest of menstruation, occasioned generally by some shock to the nervous system (in a majority of cases, cold) which paralyzes that plexus that presides over the functions of the organs concerned in menstruation. This condition causes reflex paralysis of the muscular fibres and glandular structures of the entire alimentary canal, preventing the proper digestion and assimilation of food, and giving rise to obstinate constipation followed by anæmia of the most profound kind.

The symptoms of this disease are many and varied. The first thing that the patients notice is a shortness of breath on the slightest exertion. They become easily tired; the heart beats tumultuously on going upstairs or after walking fast. They have pain at the nape of the neck and occipital neuralgia, with reflex irritation over the eyes; pain in the left side, with shortness of breath, with short hacking or loud barking cough; dull, aching pain between the shoulder blades. Feet and hands are cold on account of the feeble circulation. Appetite variable. Every one of these symptoms can be explained by weakness of the muscular apparatus of the spine.

This muscular weakness is so great that it is a task for them to hold up their heads, or even to sit erect, and this leads to curvature of the spine, which is common in these patients.

In this disease, iron must be administered systematically and perseveringly. Unless the bowels are moved, it is quite impossible for the iron to be assimilated.

Cathartics that do not weaken the intestines, should therefore be given; small doses of rhubarb, aloes, myrrh, salol, resorcin, or the salicylate of sodium, can be given.

The ovarian irritation must be overcome by the persistent application of dry heat to the feet. Vegetable bitters and mineral acids may also be given to improve the appetite.

Ammonia, for some reason, assists the stomach in digesting iron.

The following is useful in *chlorosis :*

℞ Ferri Sulphatis,	ʒ ss.
Potassii Carbonatis,	ʒ ss.
Bismuthi Carbonatis,	gr. xx.
Extracti Nucis Vomicæ,	gr. xv.

M. et fiant pilulæ No. xxx.

Sig. One pill after meals.

After *fevers,* there is always more or less anæmia; the muscles are wasted, brittle, and more or less degenerated, according to the length of the fever. The weakness of the muscular system is shown in the acceleration of the pulse, due to cardiac weakness, on the slightest exertion, as setting the patient up in bed. The administration of iron hastens and assists the reparative process, and should never be neglected, combined with other restoratives.

In diseases of the thoracic viscera : Sudden heart failure in some cases produces *epilepsy.* These patients will after the convulsion remain in a prolonged state of syncope; and, differing from other forms of epilepsy, the temperature will be lowered (as a rule, epilepsy raises the temperature). In some instances the temperature may be lowered to 95°, death frequently taking place in this state; great flatulency of the stomach is also present.

This disease is caused by fatty degeneration of the heart and consequent weakness of its muscular walls. The patient should be in the open air as much as possible, combining this treatment with iron. In conjunction with this, five drops of the tincture of strophanthus and one drop of the one-per-cent solution of nitroglycerin should be given.

The following is useful in conditions of *nervous exhaustion, muscular weakness after fevers, dyspepsia,* and weak digestive powers, with feeble propulsive power of the heart and congestion of the liver, the entire portal circulation being embarrassed, producing *jaundice,* etc.:

℞ Ammonii Carbonatis,		℈ iv.
Ferri et Ammonii Citratis,		ʒ i.
Tincturæ Nucis Vomicæ,		ʒ ij.
Tincturæ Quassiæ,[1]		
Tincturæ Gentianæ,	āā	℥ iv.
Elixir simplicis,		℥ iij.
Aquæ Camphoræ,	q. s. ad	Oi.

M. et sig. One or two tablespoonfuls after meals, in water.

Heart disease is an accident that occurs very often in early life, the result of the circulation of the rheumatic poison in the blood. This rheumatic poison in the case of children may give rise to *chorea* and heart disease, or to heart disease alone, with but slight or no affections of the joints; later on in life inflammation of the heart rarely occurs without pronounced inflammation of the joints.

This inflammation causes valvular obstruction, a mere mechanical result. Formerly it was thought that this valvular obstruction was the chief cause of heart disease. It is now known that it is not the chief, or even the common, cause of heart failure. Instead of that, heart disease is far more frequent as the result of weakness of the circulation. The muscular structure of the arteries is weakened, the circulation becomes clogged, and the heart has not sufficient power to overcome the obstruction. Now, this is caused by deficient oxygenation; the patient breathes too little, the arterial muscles begin to fail, and a quantity of blood is thrown back into the heart; the heart grows larger, but not with good muscle, and sooner or later it begins to dilate.

It should be remembered that the great danger in diseases of this kind is from muscular weakness, and the only remedy for this is oxygen; therefore iron is always indicated in heart disease, for which it is the true remedy.

It should be taken ten times in each year, for one or two weeks at a time, and the patient should be in the open air as much as possible.

On the same principle this should be the treatment in *chronic*

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[1] In giving vegetable bitters with iron, we are limited to those that do not contain tannin; otherwise ink is formed.

bronchitis, a disease combined with cough, and therefore sometimes mistaken for consumption.

The characteristics of the two diseases should be recognized immediately, for in phthisis iron should not be given; in bronchitis, iron always. These are two diseases not of the same character or nature, and do not produce the same results. Phthisis is a febrile disease; it is also a wasting disease; therefore from the first there is a tendency to shrinkage of bulk of the body, and notably of the lungs. The bones are small, especially the clavicle and the ribs. The neck is elongated, the chin being carried forward. The skin of the face is retracted, owing to the platysma myoides being put on the stretch, and hence the drawn expression of phthisis.

Bronchitis is exactly the opposite. It is not a febrile complaint, the temperature being normal. On account of the work performed, all the muscles of respiration become large, and the neck becomes very short and thick; the shoulders are elevated. Instead of the chest being flattened and contracted as in phthisis, it is barrel-shaped.

In bronchitis the great danger is in dilatation of the air vesicles, and paralysis of the muscular structure of the bronchial tubes.

The patient can be saved from emphysema, from dilatation of the bronchial tubes, from cough and consecutive weakness of the right side of the heart, by preventing muscular degeneration; hence iron should be given in bronchitis of aged persons, because of weak heart and weak lung together.

Genito-urinary tract: Uterine diseases, characterized by weakness of the uterus or its appendages, as prolapsus uteri, etc.; the chronic constipation of women; weakness of the bladder, dependent either on the degeneration of the muscular walls of the bladder or due to sluggish portal circulation; also enlargement of the prostate gland in the male.

In *diabetes,* iron should be given; constipation should be carefully guarded against in this disease, as it would be a fatal complication. The iron should be combined with a laxative

Nervous exhaustion, accompanied by the accumulation of phosphates and hæmatin in the urine, indicates a great waste of the red blood-corpuscles, and calls for the use of iron, together with the other blood and nerve restoratives, especially cod-liver oil and phosphorus.

As a Symptom or Functional Medicine.—Under certain conditions, iron acts as a symptom medicine, where its efficacy depends on its being an *antiseptic* and a *cardiac stimulant.*

Everything that increases oxygenation is an antiseptic.

When a disease has a tendency to ulceration and the production of pus, antiseptics are called for, and iron is an important one. In erysipelas, it should be given in full doses, *i.e* , as much as the stomach will bear. From one-half to one drachm of the muriate tincture can be given every two hours; it should be well diluted with water, and taken through a glass tube to prevent discoloration of the teeth. In severe cases of acute erysipelas, it may be necessary to give twenty drops every hour.

In *pneumonia,* when the temperature is low, with debilitated heart, occurring in alcoholic subjects, the muriate tincture of iron and digitalis do well.

It can also be given in *diphtheria* in a like manner.

In *phagedenic ulcers* and *chancroids* with a tendency to rapid sloughing, twenty grains of the potassio-tartrate every one, two, or three hours will often arrest the destructive process.

In chronic and indolent ulcers : Various ulcers occurring upon the leg are best treated by a wash containing five grains of the sulphate to an ounce of water ; if the ulcers are very sensitive and painful, the strength of the solution should be reduced.

The salts of iron are as follows: The proto, ferrous, or non-astringent salts ; the per, ferric, or astringent salts. The proto salts are combined with a vegetable acid, and for the most part are greenish in color. They are, in moderate doses, not at all disturbing to the stomach. They are, however, very unstable, being very readily converted into the per salts by absorbing oxygen from the air, unless protected by some such substance as sugar or honey.

One of the best of this class is the saccharated carbonate, or Vallet's mass. This is readily tolerated by weak stomachs, and the sugar prevents the air from turning it into iron rust. This is one of the best preparations to give in pill form. Quinine and nux vomica can also be combined with it.

The dose of the saccharated carbonate is from three to five grains; similar to this is the saccharated iodide of iron in liquid and pill form. The liquid form is the syrup of the iodide of iron; the pill form was formerly known as Blancard's pills, but is now an officinal preparation. Another form is the proto-carbonate, made extemporaneously by combining the sulphate of iron with the carbonate of potassium; it has already been referred to in the treatment of chlorosis.

The double salts of iron with any of the alkaloids form very uncertain preparations. There are the salts of iron and quinine, and the salts of iron and strychnine, and a triple salt of iron, quinine, and strychnine. They form scale preparations that afford the combinations sought for, but there is this difficulty; iron, being the strongest base, uses up the acid and leaves but very little for quinine and strychnine, consequently the element of quantity is uncertain.

The vegetable salts of iron are made much more soluble and pleasant to the taste by combining them with ammonia, and hence the citrate of iron is generally prescribed as the ammonia citrate. This is a soluble salt, two bases combining with one acid. This cannot be made in pill form, but should be given in solution, and is preferable to many others on account of the absence of a strong iron taste (dose, 1 to 5 grains).

Another of the vegetable salts of iron that is well borne by the stomach is the potassio-tartrate (dose, 5 to 10 grains).

The Astringent Class.—The per salts are the combination of iron with a mineral acid, and their astringency depends upon this fact.

These salts are for the most part yellow or reddish brown in color, and are more or less irritating to the stomach.

The sulphate of iron is quite astringent, with a marked metallic taste; it is one of the best preparations to give to anæmic patients with weak digestion.

Given with myrrh and aloes, it is an old prescription in the treatment of amenorrhœa (dose, one-half to one grain, three times a day). Curious in one respect—although astringent in small doses, it is a laxative in those cases of constipation due to relaxed muscular power of the walls of the stomach. It is often given as an addition to laxative pills.

The astringent form most frequently prescribed is the tinctura ferri chloridi, or the muriated tincture of iron, and is prepared by adding alcohol to the officinal liquor ferri chloridi, and contains the sesquichloride of iron, muriatic acid, and alcohol. From the reaction of the alcohol and acid, chloric ether is produced.

This preparation has a variety of actions: (*a*) it is a restorative, because of the iron; (*b*) it is an astringent, on account of hydrochloric acid and the iron; (*c*) an antispasmodic, from the presence of the ether; (*d*) a diuretic, from the same cause; (*e*) an antiseptic, because of the chlorine and the iron; (*f*) it is an expectorant and a diaphoretic, because all ethers are more or less so.

The muriate tincture can be given in spasms of the urethra, the ureter, or the bladder (dose, ten to fifteen drops every hour).

Iron is indicated where the urea is producing the anæmia characteristic of Bright's disease, and can be combined with the sweet spirits of nitre and the bichloride of mercury, as in the following:

℞ Hydrargyri Corrosivi Chloridi, ...	gr. i.
Tincturæ Ferri Chloridi, ...	ʒ ij.
Tincturæ Nucis Vomicæ, ...	ʒ ij.
Spiritus Ætheris Nitrosi, ...	℥ iij.
Elixir simplicis, ...	℥ ij.
Aquæ, ...	q. s. ad ℥ vi.

M. Sig. Two teaspoonfuls in water three times per day.

In some cases the dose of the sweet spirits of nitre may be too strong; if so, one-half of the quantity should be prescribed. After one bottle has been used, the corrosive sublimate may be left out and then resumed after another has been taken.

Administration of Iron.

1. Iron should never be given when fever is present, as it increases the febrile condition and is undigested because of the small quantity of the digestive fluids. Hence great care must

be taken in giving it to phthisical patients. It should be stopped at once on the occurrence of any febrile symptoms.

2. The dose must be in proportion to the patient's appetite. When the appetite is small, the vegetable bitters (those free from tannin, *i.e.*, quassia, gentian, and calumba) should be given to increase it. Carbonic acid and ammonia assist the digestion of iron.

3. Iron should be invariably given on a full stomach.

4. Constipation should be guarded against, and cathartics given when necessary, the best for this purpose being rhubarb and aloes.

5. Whenever possible, and especially when iron is administered in pill form, the proto-sulphate, with the carbonate of potash, should be preferred, both on account of its cheapness and the ease with which it is assimilated.

6. The stronger preparations of iron, such as the tincture of the chloride, should always be freely diluted with water, to avoid injuring the teeth and irritating the stomach.

A slight discoloration may occur from the use of any of the preparations of iron, but it is never permanent or injurious.

SUMMARY OF THE USES OF IRON.

Iron is indicated in all *anæmias*, unless they are accompanied by fever or due to some malignant disease. In *chlorosis*, the carbonate, made extemporaneously by combining the sulphate of iron with the carbonate of potassium, should be used.

After fevers there is always more or less anæmia.

The weakness of the muscular system is shown by the acceleration of the pulse, due to cardiac weakness on the slightest exertion, as setting the patient up in bed.

Iron combined with restoratives should always be given.

In *Bright's disease*, the muriate tincture, combined with corrosive sublimate and the sweet spirits of nitre, can be given.

In *diabetes*, iron should be given; constipation should be carefully guarded against.

The iron should be given with a laxative.

Nervous exhaustion, accompanied by the accumulation of phosphates and hæmatin in the urine, calls for iron.

In *chronic constipation of women ; uterine disease,* characterized by weakness of the uterus or its attachments, *prolapsus uteri,* etc.; *weakness of the bladder.* Also in *enlargement of the prostate gland* in the male.

In *cardiac disease,* the patient should be in the open air as much as possible, combining this treatment with iron.

All diseases of the heart call for the administration of iron. By increasing the muscular strength of the heart, it acts as a prophylactic to dilatation. For the same reason it should be given in *bronchitis* and *emphysema.*

In *pneumonia,* when the temperature is low, with a debilitated heart, occurring in alcoholic subjects, the muriate tincture should be given with digitalis.

It can also be given in *diphtheria* with good results.

In these cases large doses should be given, the muriate tincture acting as a symptom medicine.

In *phagedenic ulcers and chancroids* with a tendency to rapid sloughing, 20 grains of the potassio-tartrate every one, two, or three hours can be given.

In *chronic and indolent ulcers:* Varicose ulcers can be treated by a wash containing 5 grains of the sulphate to an ounce of water.

Various forms of *neuralgias,* and especially those of the intermittent type and associated with anæmia, are best treated with iron.

III. Phosphorus.

Phosphorus is a constituent of the most important tissues of the body, especially of the brain and nerve tissue. On theoretical grounds, therefore, it has been deemed by many practitioners to be a brain food, but practically this has not been proven. It certainly is not to be compared in its action as a restorative to either cod-liver oil or iron, even when given in the form of hypophosphites, etc. It is physiologically instructive to note that phosphorus, unlike iron always comes to us mixed with vegetable or animal tissues, and before it becomes a part of the system it must go through many complicated processes. The expectation, therefore, that phosphorus, given by itself, will act as a nerve nutrient does not seem to be warranted. Dissolved in oil or made into a pill, phosphorus, in a mineral form, has the following uses: It stimulates the circulation, increasing the strength and frequency of the pulse, and hence may be given as a cardiac stimulant, especially where lengthened stimulation is required, as its effects last much longer than those of alcohol or ammonia, continuing for several days after its administration has been discontinued. It is very beneficial, therefore, in *nervous exhaustion* or *neurasthenia*, characterized by a very soft and compressible pulse, whether slow or fast, with cold extremities, to stimulate the circulation. When the soft, compressible pulse is noticed in *epilepsy*, it is an indication for the use of phosphorus. It is also beneficial in some cases of *chronic meningitis* without excitement, and in *progressive paralysis of the insane*.

Phosphorus sometimes relieves very markedly certain neuralgias, notably of the trigeminus—that form of *headache* beginning with disturbance of vision (*diplopia*), or even total blindness for a few hours, attended by pain, and usually on one side only, and which is a true nervous disease. The patients are prostrated by the pain, the attack usually passing off with intense nausea and vomiting. The treatment of this affection consists in trying to prevent or mitigate the attack by giving the fluid extract of ergot in drachm doses, and repeating once if necessary. To treat the disease itself, phosphorus should be exhibited perseveringly for a month or six weeks, then rotating it every week or ten days with one-thirtieth of a grain of bichloride of mercury combined with one-twentieth of a grain of arsenite of soda. Often, however, immediate relief follows after one or two doses of phosphorus have been taken, thus showing that in these cases it does not act as a restorative, but as a neurotic.

Tic douloureux, when not due to the pressure of a tumor or organic intercranial disease, should be treated with phosphorus. It often gives very great relief, and, when it does so, the prognosis is good.

The syrup of hypophosphite of sodium is a very good remedy for nervous symptoms dependent on *cardiac exhaustion*. Thus, ossification of the aorta is the not infrequent cause, in old people, of *hallucinations,* the blood supply to the brain being irregular from weakness of the heart and aortic regurgitation. In younger people, cardiac exhaustion will cause failure of memory and will power, difficulty in concentrating the mind, depression of spirits, and irregular pulse. The hypophosphite may also be given in all forms of *passive weak delirium.* It does not do much good in *phthisis,* but may be given temporarily where the patient becomes nauseated with cod-liver oil. The syrup should always be acidulated with dilute phosphoric acid, for it is very sweet, and not easily borne by a weak stomach. Gastric irritation should always be avoided in nervous disorders. (Acid Phosph. dil., ℥ iss.; Syr. Hypophosphitum, ℥ ivss.; dose, ʒ ij. in water after meals.)

Chronic skin diseases of the *squamous variety,* where there are no red patches, only scaly, are benefited by phosphorus in combination with cod-liver oil.

In *diabetes mellitus,* the only treatment from which any permanent improvement can be expected is that by phosphorus combined with cod-liver oil and iron. It should be continued systematically even after all traces of sugar have disappeared from the urine.

Contra-indications to the use of *phosphorus* are *hæmorrhage* or *hæmorrhagic diathesis, jaundice* or *hepatic diseases.* Both these diseases are produced by phosphorus-poisoning. It is beneficial in *diseases of the spleen.*

Toxicology.—If given in excess, phosphorus acts as a caustic on the mucous membranes of the alimentary tract. In small doses it produces fatty degeneration of the liver, characterized by continued *jaundice,* and simulating *acute yellow atrophy of the liver.* The fumes of phosphorus attack the bony structures, when unprotected by the periosteum, producing necrosis. In artisans working in the fumes of phosphorus, it attacks the jawbone only when the teeth are decayed. There is no direct antidote, but oil of turpentine is claimed to act as a prophylactic. Magnesia in suspension and sulphate of copper should be used in case of poisoning.

Preparations and Administrations.—The elementary form is the best, and used in all diseases except *phthisis* and *skin diseases.* The dose is $\frac{1}{150}$ to $\frac{1}{100}$ of a grain in pill form, or as phosphorized oil (gr. iij., Olive Oil ℥ i.; dose, gtt. 5 to 10).

Tinctura phosphori is phosphorus dissolved in glycerin and water, and flavored with peppermint. It has not the disagreeable taste of the solution in oil, and does not regurgitate. The dose is one drachm in a little water or wine.

Phosphorus dissolved in chloroform, ether, and sulphide of carbon is also used.

Compound phosphorus pill contains phosphorus, strychnine, quinine, or iron. The hypophosphites part with their phosphorus in the body and thus give the effects of phosphorus itself (dose, Hypophosphites, gr. viii.–xv.; Syrup of Hypophosphites, ʒ i.–ii.).

IV. Quinine.

Quinine is an alkaloid obtained from the bark of the cinchona tree. This tree received its name from the wife of a Spanish consul at Peru, the Countess of Cinchon, who, having been cured of a malarial fever by using its bark, introduced it into Europe. The officinal varieties of cinchona are the barks of the Cinchona flava and Cinchona rubra. The barks which are richest in quinine and allied alkaloids are obtained from trees growing on the Andes, where the rainfall is excessive and the atmosphere charged with vapor. The red and the pale barks of Peru, although rich in the alkaloids, are inferior to the yellow bark of Bolivia. Of late years, large amounts are shipped from India and the island of Java.

Quinine is a restorative, being a food, because it is analogous to one of the normal constituents of the system, viz., taurin; a deficiency of this is always accompanied by more or less disturbance of health, which yields to the use of quinine. Taurin is a nitrogenized crystalline body secreted by the liver, and found in the bile together with cholic acid and sodium, forming the taurocholate of sodium. About one ounce of taurin is daily poured into the intestines and reabsorbed into the circulation, where its office seems to be that of a germicide or natural antiseptic to prevent and arrest the development and multiplication of bacteria and other microscopic germs which find their way into the system.

A consideration of the physiological properties of quinine shows a great similarity between it and taurin; again, the majority of cases in which quinine is indicated depend upon some derangement of the functions of the liver.

THERAPEUTIC USES OF QUININE.

As an Antiperiodic.—All forms of malarial fevers are benefited by quinine, as well as many diseases and disorders of malarial origin. It has now been demonstrated that malaria depends on an infection of the system by a low organism which enters the red blood-corpuscles and destroys them. Marked periodicity is a special and distinctive characteristic of malarial disorders, and where this is absent the term malarial should never be applied to any disease. The periodic symptoms of malaria may be extremely varied. Often it will be high fever, but it may be just the opposite—a subnormal temperature not followed by fever; the disease may appear only at a certain time, with first chills, then high temperature, fever, and sweating; or it may appear at a certain time with sweating as the only symptom. This period of time also varies considerably. The attacks may occur every hour, every day, every two days, three days, once a week, etc. In some cases the symptoms may be purely nervous, as brow ague, intercostal neuralgia; in other cases there may be abdominal pain with disturbance of motion; in others, opisthotonos, and very commonly, in children, coughing is the only manifestation of the disease. (In endeavoring to discover from the patient if there has been periodicity in the symptoms, do not ask if he has had a fever or headache at such and such a time, as he will be very apt to reply that it has been continuous, but ask if he does not feel better at certain times. An answer to this question in the affirmative indicates periodicity just as well as by the former method.) The following instance illustrates the masked form which malaria often assumes, and at the same time the periodicity of the disease: A man was sent to Roosevelt Hospital in a state of coma, apparently uræmic, with diagnosis of acute nephritis. Temperature, 104° F. Considerable quantity of albumin and blood in the urine. The patient, however, would come out of the comatose condition in the forenoon and return to it in the afternoon. The blood was examined under the microscope, and evidences of malarial infection were found. The administration of quinine twice daily in twenty-grain doses was followed by complete recovery in a month from date of admission. A large proportion of the cases of chronic Bright's disease have begun as malarial congestions and inflammations, and quinine, if given early and in sufficient quantity, would often have prevented the disease. In the fevers of children, if blood is present in the urine, it shows malaria to be present. and is an indication for the exhibition of quinine.

This periodicity is especially characteristic of the malarial fevers, the intermittent and remittent. An *intermittent fever* is a fever in which the febrile exacerbations occur in regular succession, and between the exacerbations there is complete absence of fever, the temperature being normal or even subnormal. Gradually the periods of cessation of fever get shorter and shorter, until finally the fever becomes remittent. A *remittent fever* is continuous throughout the twenty-four hours, but at certain times there are marked remissions in its severity. It does not altogether abate, for if it did the fever would be *intermittent*. The particular time in the day at which the fever diminishes is called the period of remission, and corresponds to the time when, in the intermittent stage, the fever was completely in abeyance. The majority of fevers have more or less remission, especially at the beginning of their course, but it is not periodic, as in the malarial fevers, and occurs at the period of greatest vitality, viz., between 8 and 10 A.M. Quite a number of other affections besides ague have chills and fever, but unless there is decided periodicity they are non-malarial. Thus the discharge of pus or the passage of gall stones will occasion chills followed by fever and sweating. In pernicious anæmia and in malignant disease, there will also be chills and fever. Quinine must not, therefore, be given indiscriminately whenever there are chills and fever, for, unless malarial, the disorder will often be aggravated by its use. If quinine is not needed, it acts as a local irritant to tender stomachs, and in fevers there is always more or less tenderness of the stomach.

The dose of quinine to be given in malarial fever depends on the virulence of the infection, which generally varies with the locality. Some malarial affections are very severe; for example, in that form of malaria called *malignant congestive chill*, the worst examples of which occur in Africa and on the shores of the Dead Sea, there is a sudden depression of the heart's action; the patient pants for breath, the voice is lost, and the gums have a dreadful appearance; there are cramps in the calves of the legs, and a burning sensation in the pit of the stomach; the skin shrinks, and the face assumes the Hippocratic aspect. Generally the second chill in this disease is fatal. The mode of treatment successfully adopted in one of these cases, was the immediate administration of thirty grains of quinine, followed, after an hour's interval, by thirty more, and after another hour by thirty more. It was not till the last dose had been taken that the patient showed any signs of having taken quinine. The principle of the treatment was to follow up the deficiency in the system that called for quinine.

In mild cases, ten grains are sufficient. In New York and vicinity, twenty grains are required; farther South, as in some parts of North Carolina, forty to fifty grains; while in the tropics less than sixty grains will not produce any effect in severe cases. The quinine appears to be used up in the system while it is counteracting the malarial agent, so that no trace of the drug is found in the secretions, nor does it produce any symptoms of its own while it is acting on the disease. Two or three grains will produce cinchonism in the healthy, while twenty to sixty, or, as already mentioned, even ninety grains will not produce these symptoms where there is malaria. The symptoms of cinchonism vary in different people. In some cases there is disturbance of audition, sound always seeming to come from a distance; other patients have muscular tremors; a less frequent symptom is palpitation of the heart, and occasionally patients have frontal headache. The most general symptom, however, is *tinnitus aurium,* and this, when produced, shows that the maximum dose has been reached, and, if pushed further, that the remedial effects of quinine will be lost.

The next point to be considered is the manner of administering quinine for the purpose of breaking up an attack of ague. In the first place, no patient recovers from this disease under twenty-eight days, no matter how well he may appear. A large dose of quinine may cause the disappearance of the recurring chills and fever during that period, but the disease is not cured; for at the time when these symptoms would otherwise have appeared—daily if quotidian, etc.—there will be a sudden increase in the amount of urea, phosphates, etc., excreted in the urine. On the seventh day there will be an increase nearly double that of the intermediate days, and again on the fourteenth and twenty-first days. The continued presence of the germs prevents the disease from disappearing, and the growth and fructification of several generations occasion the relapses. The germs may remain in the system five or six months without developing sufficiently to produce any symptoms of disease. In this city, malarial troubles are most common in the months of April and September. In spring, the outbreak of malaria is due to the rejuvenescence and multiplication of minute forms of vegetable life in water, which afford a soil for the development of the malarial organism; and if a patient has an attack in April, the probabilities are that he will have another in the fall, and again on the anniversary of the first attack. Whatever lowers the vitality of the system, such as loss of sleep, severe changes of weather, etc., will, in those who are subject to malaria, cause a recurrence of the disease. If the chills and fever remain unbroken for months, the patient loses vaso-motor control over the circulation of the liver and spleen,[1] and very slight causes, such as an ordinary wetting in a summer shower, will cause an enlargement of these organs and consequent interference with their functions. The administration of quinine should therefore be preceded by a cathartic—calomel or blue pill—to free the portal circulation, which if congested would hinder absorption, as quinine, morphine, and all the vegetable alkaloids, if they remain for much length of time in the alimentary canal and are subjected to the action of the ordinary digestive fluids there, become so changed as to lose largely their special properties. The congestion must be removed by brisk catharsis, produced either by a couple of compound cathartic pills, or ten grains each of calomel and jalap with a few grains of bicarbonate of soda to prevent griping, or, what is better still, by the following:

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[1] See article on Cold, p. 276.

℞ Pil. Hydrargyri,	gr. iv.
Sodii Bicarb.,	gr. x.
Ex. Colocynth. Co.,	gr. vi.

M. et div. in capsul. No. iii. Sig. One at night.

The quinine is to be given with the first movement of the bowels. Three or four days afterwards a cathartic should again be given, as there is a constant tendency to *splenic* and *hepatic congestion.*

There is constant failure in the treatment of malarial poisoning by the use of quinine, and it nearly always arises from the manner in which the remedy is administered. The point to be obtained is the quick absorption of the quinine. Suppose, for example, you are called upon to prescribe in a case of malarial poisoning in which there is almost continuous vomiting, as in *bilious fever*. If there is gastritis present, there will be tenderness upon pressure at the pit of the stomach and in the region of the gall bladder; there is apt to be some swelling of the epigastrium, and the patient vomits as soon as anything is taken. It is useless to administer quinine by the mouth under such circumstances, because the excessive irritation which it produces upon an inflamed mucous membrane causes its rejection at once. If injected into the rectum under the same circumstances, it will not succeed any better, because rectal absorption is diminished on account of portal obstruction.

Now, if two or three leeches are applied at the epigastrium, the vomiting will be arrested almost certainly, and the quinine will be absorbed. Do not use either mustard or blisters here to arrest the vomiting, for they are vascular stimulants. Topical blood-letting, on the other hand, is a prompt vascular sedative.

The next point is that in malaria quinine should never be given alone, but combined with spices which render its absorption more rapid and its effects more lasting. Capsicum combined with quinine will diminish the size of the dose requisite, and the same may be said of ginger and other aromatics. A good dose of capsicum combined with twenty grains of quinine will act as well as thirty grains of quinine without the capsicum. Spices in general stimulate the portal circulation and promote the flow of bile, and hence their universal use in hot climates. There is a tendency on the part of quinine and capsicum to purge, and sometimes to purge violently. In such cases, the purgative action is caused by the increased flow of bile produced by the capsicum. Ginger and quinine, when combined, do not purge, and make a very good combination. If the medicine is administered in form of pills, capsicum may be preferable, because of the less bulk required; but, if desirable, the ginger may be given separately, and with the same effect as when combined with the quinine. The proportions should be one grain of capsicum to three of quinine; with ginger, one grain of each. Quinine may also be given in combination with nutmeg in the same proportion as with capsicum.

Ginger in large doses will sometimes be very effective, and may be given in cases of malaria where quinine fails to act. In obstinate cases, all three—ginger, nutmeg, and capsicum—in what is called "compound nutmeg capsule," should be used. A nostrum called Warburg's Tincture is very extensively used in this country and in India for malaria. As originally made it contained no less than seventy-six spices, and six grains of quinine are more effective, given in combination with this mixture, than thirty or forty given alone. The reason is that the spices stimulate the portal circulation, and have also an antiperiodic action, as they belong to the carbolic-acid series. These ingredients are now prepared in the form of capsules. As aloes is one of the drugs used, if six or eight of the capsules are given during the day severe diarrhœa may be caused. This, however, may be avoided by ordering the administration of capsules which do not contain aloes.

The subsequent treatment of ague is to follow up the dose which breaks the attack with one-half that quantity daily, till the seventh day after the last chill, when the full dose should be given. (If there is any uncertainty as to which is the seventh day, the full dose may be given for two days in succession.) Continue the treatment with one-third of the original dose till the end of the fourth week, giving the full dose on every seventh day. The patient, if he has not had the disease before, will in all probability now be out of danger, and quinine may be given simply as a prophylactic. The dose for this purpose is one-tenth of that which had been required to break the chills, though six grains may safely be given.

As an Antiseptic and Disinfectant.—Quinine chemically is very similar to the carbolic-acid series of disinfectants, and especially salicylic acid. A solution of one grain of quinine to twelve ounces of water will destroy the movements of bacteria in putrescent urine. Depending on this principle is the use of the injection of two-thirds of a grain of quinine to an ounce of water in *chronic cystitis,*[1] to prevent the decomposition of mucus and sometimes of pus. For this reason quinine should always be given in those cases where *blood poisoning*, or *septicæmia,* results from the absorption of septic material from deep-seated *abscesses;* where the infection is taking place from the surface of an open wound, a solution of carbolic acid or other disinfectant should be used locally with the internal use of quinine.

As an Antiphlogistic and Antisuppurative.—Quinine destroys the vitality of the white blood-corpuscles, producing in them a condition similar to that found in "rigor mortis." Some suppose that quinine prevents the nutrition of the leucocytes, and thus checks inflammation and suppuration. Whether this is so or not, it has been clinically demonstrated that it is always indicated in cases of prolonged suppuration, as *psoas abscess, pneumonic phthisis, fistulous discharges,* etc. Under these conditions there is an increased tolerance of the drug; large doses (twenty grains) failing to give rise to the symptoms of cinchonism. When symptoms of cinchonism occur, the use of quinine should not be pushed any further, as nothing will be gained.

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[1] For other disinfectant remedies for this disease, see p. 36.

As a Restorative or Febrile Food.—In *fever*, the function of the liver, together with that of all the glands, is impaired, and the composition of the blood more or less altered. Hence on recovery from a fever the patient is always more or less jaundiced. In all *febrile diseases*, quinine is the restorative and should be administered, both during and after the fever, in restorative doses of from four to six grains a day.

Where malaria has become chronic, organic changes will often take place, the liver and spleen will be enlarged, the blood will be very impoverished, and quinine may fail to do any good. Not infrequently in these cases the old-fashioned remedy of infusion of cinchona bark will be very effective, for it contains all the alkaloids, and a very pleasant combination of tannin called quinic acid, which has the property of allaying nausea, and tannin in small doses, is a valuable medicine for weakness of the muscular coats of the stomach and intestines. In *chronic diseases of the bladder*, advantage will often be gained by giving this infusion; the appetite will be increased, the blood improved, and its effects against malaria are shown by the gradual decline of the disease.

As a Neurotic.—In common with the other members of the carbolic-acid series, quinine possesses anæsthetic properties. It may be given to relieve pain that is neuralgic, not inflammatory. The distinction between these two kinds of pain is very important and very practical. An inflammatory pain is caused by the pressure or stretching of the nerves by the inflammatory exudation, and has the following characteristics: It cannot bear pressure, and consequently the patient avoids movements likely to exert pressure upon the seat of pain; it is local, and the pain is throbbing from the pulsation of the arteries against the nerves. Opium is the neurotic for inflammatory pain. Neuralgic pains have none of these characteristics; as a rule, they are not strictly local, but, on the contrary, have a tendency to radiate, and they are relieved by pressure and consequently by movements. Quinine, antipyrine, and antifebrin are the neurotics for neuralgic pains. Quinine is sometimes extremely successful in neuralgic pains which are periodical and which may be the only manifestations of malarial infection, *e.g.*, *brow ague* and *malarial headache*. In the latter complaint, the face will be marked by yellowish streaks running from opposite angles of the eyes, and similar lines run toward the mouth in a manner peculiar to malarial jaundice. The headache may continue from ten to fourteen days, or even longer; it does not, however, usually last longer than two weeks.

As a rule, malarial headache either remits or intermits. It always sets in suddenly. It often commences at a certain hour of a certain day, and at the same hour of the following days it is more severe than at any other time within the twenty-four hours. A true malarial headache is as violent at its commencement as at any time during its course. In a large proportion of cases, there will be times when the patient has either decided chills or chilly sensations. There may be nothing more than the hands getting cold previous to the occurrence of the headache. It is usually frontal, and sometimes felt on one side only.

Of course, as a neurotic, quinine in these cases must be given as a symptom medicine, not as a disease medicine, and therefore should be given in a single large dose. The dose should be twenty grains. If the stomach is in an unsettled condition, the dose may be divided into two, the second to be taken half an hour after the first. As ergot greatly promotes the action of quinine as a neurotic, one drachm of the fluid extract, or from twenty to thirty grains of the powder, or fifteen to twenty grains of the solid extract (Squibb's), may be given with the twenty grains of quinine.[1]

As an Antipyretic.—To a certain extent quinine is a symptom medicine. When taken in a certain way, it has the power of reducing the temperature of the body 1° to 3° F. by a dose of twenty grains. This power it has in common with all the carbolic-acid series. Certain investigators claim that the antipyretic action is dependent on arrest or diminution of oxidation and tissue metamorphosis. Its use and that of all other medicinal antipyretics is contra-indicated in all prolonged fevers and wherever there is cardiac weakness, for, though lowering the temperature, they also weaken the heart's action.

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[1] See also Ergot, page 200.

The four principal alkaloids of Peruvian bark are quinine, cinchonine, quinidine, and cinchonidine.

Quinine is the best and has the greatest antiperiodic power. Cinchonine is largely used in the adulteration of quinine; its action is very similar, only weaker—twenty grains of cinchonine are about equal to fifteen grains of quinine. Cinchonidine in combination is quite as active as quinine and as expensive. The four alkaloids have been combined under the name of quinetum.

All the alkaloids disturb the stomach more or less; but quinine is the mildest. In a few cases, a decoction of the bark acts more powerfully than any of the alkaloids. It contains quinic acid and a little tannin.

Administration.—The crystallized sulphate of quinine is used to a greater extent than any other of the preparations. It is freely soluble in water slightly acidulated with either the dilute or aromatic sulphuric acid. When quick effects are desired, this is the best way to administer it, as it is immediately absorbed. The solid crystals are soluble in the gastric juice, although liable to be decomposed in part. Quinine should be given on an empty stomach, or after the active part of digestion is over.

Quinine pills are apt to pass through the alimentary canal undissolved unless fresh. They should not be kept more than ten or fifteen days, no matter what protecting coating they may have. In pill form, spices should always be in combination, as they promote the action of the quinine.

The intense and persistent bitter taste of the soluble salts of quinine often makes it desirable to administer it in a more palatable form, especially for children.

The following formula is the best:

℞ Quin. Sulph.,	gr. xij.
Acid. Tannici,	gr. iij.
Syr. simplic.,	ʒ iv.
Aquæ Cinnamom.,	℥ i.

M. Sig. To be shaken. Teaspoonful dose.

dyspepsia, the patient feels worse before eating than after,
ood relieving the gastric uneasiness; but an hour or so af-
ard there will be a recurrence of the unpleasant symp-
. In *gastritis,* the patient is worse after eating than
re; pressure on the epigastric region occasions pain, the
is abdominis is often in a state of chronic rigidity, there is
ggravating feeling of heaviness in the pit of the stom-
and the face has a mournful expression. When a patient has
itis, do not give anything containing alcohol, and con-
ently the tinctures of the vegetable bitters should not be
. A very good combination to relieve the pain and other
ries of chronic gastritis, especially if ulceration is feared, is
l parts (ten grains) of powdered calumba and subcarbonate
smuth.

e following general rules may be laid down for the use of
class of medicines:

If bitters fail to improve the appetite, there is no ad-
ge in continuing their use; for, with a few exceptions,
therapeutic value is limited to their influence over this
unction.

If the appetite is good but the digestion is bad, no benefit
be derived from the use of vegetable bitters; for the diffi-
is beyond the reach of this class of remedies, being gener-
n the intestines.

If the secretion of gastric juice is interfered with by
organic disease, then the use of the bitters is useless, if
njurious. In *fevers,* there can be no appetite as long as
mperature remains high and suppresses the secretion of the
tive juices, and therefore in this stage they should not be
.

When the fever has subsided and the recovery begins,
the vegetable bitters are needed to stimulate the appetite;
if the patient is voracious and in danger of over-eating,
they are contra-indicated.

The tinctures of vegetable bitters are injurious in all
of catarrh of the mucous membrane of the stomach, as
itis, etc. In these cases the infusions are indicated. If
yspepsia is nervous without gastritis, with the unpleasant

In the administration of vegetable bitters, the best to begin with is cinchona, or *Peruvian bark*, especially where the anorexia is the result of fever.

In *nervous dyspepsia*, and to awaken the appetite after fevers, the compound tincture is the best (dose, two teaspoonfuls three times a day). In dyspepsia, with rather abundant alkaline urine and charged with phosphates, alcohol is indicated; but, to prevent the alcohol habit being formed, it should be combined with some bitter, either quinine (dose, gr. i.) or quinidia or cinchonidia (dose, gr. ij.–iij.). For loss of appetite in females due to *nervous debility* arising from ovarian irritation, the mineral acids, combined with vegetable bitters, are beneficial.

Quassia, *gentian*, and *calumba* are very similar in their qualities as bitters. They are free from tannic acid, and are therefore adapted for combination with iron in the treatment of *anæmia*, gentian being the one most frequently used.

Quassia is the wood of the Picræa excelsa, a large tree growing in the West Indies. It has an intensely bitter taste, but does not disagree by producing nausea. The preparations are: the infusion (ʒ ij.–Oi.), dose one or two teaspoonfuls; and tincture (ʒ i.–Oi.), dose one-half to a teaspoonful. As it is highly poisonous to insect life, a strong infusion (℥ ij.–Oi.), to which common salt has been added, is often used as an enema to destroy *ascarides* in the lower portion of the large intestine and rectum, as it does not produce any local irritation.

Gentian is the root of the Gentiana lutea, a plant growing in the mountainous regions of Europe. Its taste, being somewhat aromatic, is pleasanter than that of quassia. Its infusion is inferior to that of the compound infusion of Peruvian bark. When iron is to be given in connection with a vegetable bitter, the *compound* tincture of gentian should not be used.

Calumba, or *columbo*, is the root of the Jateorrhiza calumba, a climbing plant of Mozambique. It is an admirable bitter in cases of *chronic gastritis*. As cinchona, quassia, and gentian are to be given for nervous dyspepsia, and calumba for the dyspepsia caused by gastritis, the distinctions between the two forms should be thoroughly understood, as the indiscriminate administration of these bitters might be injurious. In *ner-*

vous dyspepsia, the patient feels worse before eating than after, the food relieving the gastric uneasiness; but an hour or so afterward there will be a recurrence of the unpleasant symptoms. In *gastritis,* the patient is worse after eating than before; pressure on the epigastric region occasions pain, the rectus abdominis is often in a state of chronic rigidity, there is an aggravating feeling of heaviness in the pit of the stomach, and the face has a mournful expression. When a patient has gastritis, do not give anything containing alcohol, and consequently the tinctures of the vegetable bitters should not be used. A very good combination to relieve the pain and other miseries of chronic gastritis, especially if ulceration is feared, is equal parts (ten grains) of powdered calumba and subcarbonate of bismuth.

The following general rules may be laid down for the use of this class of medicines:

1. If bitters fail to improve the appetite, there is no advantage in continuing their use; for, with a few exceptions, their therapeutic value is limited to their influence over this one function.

2. If the appetite is good but the digestion is bad, no benefit will be derived from the use of vegetable bitters; for the difficulty is beyond the reach of this class of remedies, being generally in the intestines.

3. If the secretion of gastric juice is interfered with by some organic disease, then the use of the bitters is useless, if not injurious. In *fevers,* there can be no appetite as long as the temperature remains high and suppresses the secretion of the digestive juices, and therefore in this stage they should not be given.

4. When the fever has subsided and the recovery begins, then the vegetable bitters are needed to stimulate the appetite; but if the patient is voracious and in danger of over-eating, then they are contra-indicated.

5. The tinctures of vegetable bitters are injurious in all cases of catarrh of the mucous membrane of the stomach, as gastritis, etc. In these cases the infusions are indicated. If the dyspepsia is nervous without gastritis, with the unpleasant

sensations occurring *before* eating, then the tinctures are indicated.

6. As appetizers, they should be taken two or three times a day, and always half an hour to an hour before each meal, so as to obtain the effect of the medicine and prepare the stomach to receive and digest the food.

7. When it is desirable that bitters be used continuously for any length of time, a change should be made every ten or twelve days, substituting one for another. If any one form be given longer than this period, it loses its power over the stomach and becomes repulsive, as the stomach abhors monotony.

Preparations—

CINCHONA OR PERUVIAN BARK.

Quassia.	Extractum Quassiæ, . . .	gr. i.–ij.
	Extractum Quassiæ fluidum, . .	gtt. v.–x.
	Tinctura Quassiæ (1 in 10), . .	ʒ i.
Gentian.	Extractum Gentianæ, . . .	gr. ix.–x.
	Extractum Gentianæ fluidum, .	gtt. x.– ʒ ss.
	Tinctura Gentianæ composita, . .	ʒ i.– ʒ ij.
	Stoughton's Elixir is also a good preparation.	
Calumba.	Calumba powdered, . . .	gr. x.– ʒ ss.
	Extractum Calumbæ fluidum, .	gtt. xv.– ʒ ss.
	Tinctura Calumbæ. . . .	ʒ i.– ℥ ss.

VI. Mineral Acids.

The principal members of this group of the restorative class of medicines are hydrochloric acid, sulphuric acid, nitric acid, nitro-muriatic acid, and phosphoric acid. The three acid secretions of the body are the gastric juice, the urine, and the perspiration. The gastric juice depends for its acidity on the presence of a small quantity of free hydrochloric acid, probably formed by the decomposition in the system of sodium chloride; the acidity of the urine is due to the presence of acid sodium and potassium phosphates; that of the perspiration to various organic acids. The acidity of the urine is liable to temporary variation from the use of certain fruits and vegetables, but otherwise the alkalinity of these secretions is a morbid condition, and its continuance is incompatible with health. The most frequent cause of this condition is depressed nervous vitality, and the exhibition of the mineral acids is indicated to counteract the alkalinity. Thus patients who have indulged in excessive venery often have wet hands and feet from a cold, clammy perspiration, alkaline instead of acid in reaction. There is also not infrequently a deficiency of acid in the gastric juice, giving rise to a peculiar form of *dyspepsia* different from that dependent on organic changes, such as gastritis, etc., as the patients are relieved by food. Mineral acids should be given in these cases as appetizers and to promote digestion. The effect of moist heat is another illustration of alkalinity of these secretions following depressed nervous vitality, as it not only makes the gastric juice and urine alkaline, but also reduces the acidity of the blood where it is charged with acid salts, as in *gout* and *rheumatism*. Hence the use of the warm bath in these diseases. This also accounts for the inability of the stomach to digest food taken shortly before a bath. The rule in the treatment of *nervous debility*—a condition in which the vitality of the system is reduced either by an excessive drain of nervous force or by faulty nutrition—is to examine the urine. If neutral or alkaline, and there is a weak, compressible pulse, alcohol unfortunately is the only remedy. It should be given with the food, and to aid digestion mineral acids should also be given. If the urine is acid and of high specific gravity, the administration of alcohol and the mineral acids is injurious. It is to be remembered that when an acid secretion becomes alkaline as the result of disease, it is very difficult to restore its normal reaction, while, on the other hand, an acid secretion is easily rendered alkaline by the action of any depressing influence.

All the mineral acids are more or less astringent, and may be used to arrest fluxes and hypersecretions.

Hydrochloric Acid.—This acid is a natural ingredient of the body, and subserves some very important digestive functions. In certain diseases it disappears, in others it is in excess. *Cancer* in any part of the body causes a deficiency of hydrochloric acid in the gastric juice, and this enables us to ascertain whether a disease of the stomach is malignant or due to a small ulcer.

Hydrochloric acid is also absent in typhoid fever. It has been demonstrated by experiment that the stomach is more wasted in this fever than in any other. This acid combined with pepsin should therefore always be given in *typhoid fever*. In certain forms of *dyspepsia*, hydrochloric acid is in excess; in other forms there is a deficiency. How can we tell the difference? The patients are more often women than men, and come from a nervous family. They will complain of considerable distress after eating, of a burning sensation in the stomach, of temporal headaches, of having thrown up intensely acid material, and withal they are very hysterical. If the breath and vomit have a sour smell, it is due to acetic acid fermentation in the stomach caused by the absence of hydrochloric acid and pepsin, the natural antiseptics of the stomach. On the other hand, if there is an excess of hydrochloric acid, the vomited matter will be of acid reaction; but it does not smell sour, as hydrochloric acid is not so volatile as acetic acid. In the latter condition, alkalies, particularly in the form of the alkaline mineral waters, are indicated. In the former, vegetable bitters, bismuth, and hydrochloric acid should be given, of course not with any hope of curing the disease where the absence of the acid is due to cancer. Repeated vomiting, two or three times a week, of large quantities of fermentative material is due to a form of dyspepsia that can be cured in no other way than by washing out the stomach—a plan which has succeeded where everything else has failed *Preparations:* Acidum Hydrochloricum, gtt. v.–x.; Acidum Hydrochloricum dilutum, gtt. xv.

Sulphuric Acid.—Though not a natural ingredient of the body, this acid has the same power to increase the appetite and aid digestion as hydrochloric acid. It also possesses decided astringent properties, being especially good for two fluxes, *passive diarrhœa* and *hyperidrosis*. It is the popular remedy for the sweats of *phthisis*. For this purpose it should be given three or four times during the day and sometimes during the night.

Nitric Acid.—This acid possesses decided advantages over hydrochloric and sulphuric acids as an astringent, particularly to check excessive secretion of the bronchial mucous membrane.

It is therefore to be recommended for *bronchorrhœa,* and in those cases of bronchial relaxation in old persons with feeble heart who cough incessantly during the night and raise a great deal of watery mucus. Nitric acid is not to be given where there is a cough with viscid secretion, as the cough is only aggravated and the secretion becomes more tenacious. In *chronic bronchitis,* where secretion is excessive, nitric acid and iodide of potassium combined do a great deal of good. Before the introduction of cod-liver oil, nitric acid used to be the great remedy for *phthisis,* but it should only be used in this disease when there is excessive mucous secretion. It is also useful in *whooping-cough* to check secretions, if they are too free. In *serous diarrhœa* (summer diarrhœa), where there is need of an astringent, nitric acid is frequently used and may be added to the usual prescription.[1] *Preparations:* Acidum Nitricum, gtt. v.–x.; Acidum Nitricum dilutum, gtt. x.–xv.

Nitro-muriatic Acid.—This acid is prepared by adding one part of strong nitric acid to two parts of strong hydrochloric acid, or, as it is generally prepared, by taking five parts of the latter to three of the former. They unite with effervescence and evolution of orange-colored fumes, and an entirely new substance is formed. That it is a definite chemical compound and not a mixture is proved by its independent and characteristic qualities, as well as by the fact that, if the acids be first diluted before mixing, no such action takes place. On the other hand, the nitro-muriatic acid made from the concentrated acids can be diluted to any extent without losing any of its physiological or chemical properties. If the nitric and muriatic acids are not of sufficient strength to form this compound, by adding a few drops of sulphuric acid (which takes up the excess of water) the desired strength can be obtained, and the two acids unite with the characteristic reaction. If the acids do not instantly combine, do not put a cork in the bottle, as they sometimes combine afterward, bursting the bottle, if it is closed, and occasionally producing very unpleasant results. This compound is unstable, and undergoes partial decomposition if kept too long. It is better to make it fresh as occasion requires.

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[1] See p. 237 for prescription for summer diarrhœa.

This acid is a powerful oxidizer, and its value is chiefly in its stimulation of the action of the liver, and of the glandular structures of the alimentary canal. Many disorders of the system are due to the defective oxidizing power of the liver; retrograde material which ought to be converted into urea being formed instead into uric acid, and this material, if greatly in excess, gives rise to the gouty diathesis with its attendant disorders. One of these disorders is *oxaluria,* the marked feature of which is depression of spirits and hallucinations. The passage of oxalic acid crystals down the ureters produces hæmorrhage and more disturbance than uric-acid calculi. Nitro-muriatic acid given one hour after each meal counteracts oxaluria. How it does so we do not know. It certainly increases the flow of bile, and may therefore also be used in slight attacks of *jaundice. Preparations:* Acidum Nitrohydrochloricum, dose, gtt. iv.; Acidum Nitrohydrochloricum dilutum, dose, gtt. x.–xv.

Phosphoric Acid.—This acid has few therapeutical uses compared with the other mineral acids. Apparently it has no power to increase the appetite, promote digestion, or affect any of the secretions. It is to be recommended only as a cooling drink for the thirst of fever (Acidum Phosphoricum dilutum, ʒ i.; Aqua, Oi.).

Administration of the Mineral Acids.

The mineral acids should never be given in concentrated form, as there is an officinal dilute preparation of each, of which the dose is on the average fifteen minims.[1] Even the dilute preparations must be still further diluted to avoid injuring the teeth. When these remedies are used for any length of time, it must be remembered that the system cannot bear an excess of acid, so that upon the first symptoms of intolerance, griping, and diarrhœa with strongly acid urine, their exhibition must be stopped at once and for a long time. Otherwise the hyperacid urine will cause irritation of the kidneys, with formation of uric-acid gravel and perhaps calculous deposit. Patients with oxalic-acid diathesis must be cautioned against the protracted use of the mineral acids, as the relief afforded often leads them to their use independently of the physician's advice.

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[1] In prescribing the dilute preparations, remember that the dilution is with water, sixty drops to the drachm. Aromatic sulphuric acid is really a tincture, as it has an alcoholic menstruum, and there are consequently one hundred and twenty drops to the drachm.

VII. Alkalies.

During life the reaction of the blood is strongly alkaline. This condition is necessary to life, for, before the blood is reduced even to neutrality, death takes place.

Alkalies are therefore natural to the body, and when they are deficient, or the acidulous radicals are in excess in the blood, their use is indicated.

This condition is characteristic of *acute articular rheumatism, pyæmia, scarlet fever, scarlatinal rheumatism*, and *gonorrhœal rheumatism*, and the danger in these cases is in direct proportion to the acidity of the secretions, *endocarditis* being induced.

The only reliable treatment of these disorders is the alkaline, and no plan or system of treatment in rheumatism has proved as efficient in preventing cardiac complications.

Salicylic acid and the salicylates possess in a marked degree the power of controlling the pain of acute rheumatism, but they do not prevent or arrest endocarditis, except by shortening the average duration of the rheumatism.

The most reliable guide in the treatment of rheumatism is the reaction of the urine. If the urine be rendered alkaline, and kept so during the entire course of the disease, the danger of cardiac complications is reduced to the minimum.

A mixture of several of the alkaline salts is usually given; a small dose of paregoric, ʒ ss.–ʒ i., may be added to prevent purging.

The following is the usual formula:

℞ Potassii Bicarbonatis, ...	ʒ iss.
Potassii Acetatis, ...	ʒ ss.
Potassii Nitratis, ...	gr. xx.
Acidi Citrici, ...	℈i.
Liq. Ammonii Acetatis, ...	℥ ij.

M.

The whole should be taken at one dose, and repeated every one, two, three, or four hours until the urine is alkaline. It should be rendered alkaline as soon as possible, and kept so until the attack is over.

If necessary, the frequency of the doses may be increased or diminished, but not their *magnitude*.

In gouty diatheses, the quantity of uric acid formed is so great that the urine cannot hold it in solution, and gravelly deposits result.

The alkalies increase the solvent powers of the urine for these deposits, and should be given as prophylactics against calculi, as well as to diminish the renal and vesical irritation. The vegetable salts are to be preferred to the carbonates, as they act more readily on the kidneys. Ripe fruits, since they contain more or less citrates, tartrates, and malates of potash, are useful in a gouty diathesis. If the vegetable salts do not succeed, the liquor potassæ, in doses of half a drachm to a drachm freely diluted in water, will act. The objection to it is that it is likely to interfere with nutrition.

Those skin diseases which are due to a gouty diathesis, as *gouty eczema*, *lepra*, *psoriasis*, may be benefited by the use of the alkalies, both internally and locally. If the secretion from the diseased surface is acid, sodii bicarb. (ʒ ij.–Oi.) is a good wash. If stronger than this, it will often irritate. Abstinence from animal food will often render the secretions alkaline, and the cutaneous eruptions will disappear. Acidity of the alimentary canal, shown by sour eructations, sour vomiting, acid and irritating stools, is caused by fermentations due to deficiency of digestive juices, which, when present, act as antiseptics and prevent all such decomposition; with the treatment to restore the secretions, temporary relief may be obtained from the use of alkalies. Lime is to be preferred on account of its power in neutralizing acids. Ordinary lime-water is sufficient, but Clelland's saccharated solution is preferable. It is made by rubbing together eight ounces of quicklime to five of sugar, and adding gradually one gallon of water. Each ounce contains eighteen grains of lime. (Dose, gtt. xx –xxx., well diluted with water, two or three hours after meals.) It is often useful to correct acidity accompanying sick headache. In children, especially when artificially fed, acidity is very likely to be due to too much casein in the milk. Cow's milk contains much more casein, but less fat, sugar, and salt, than human milk. Cream should be, therefore, added, together with sugar and a little salt, and the whole diluted with three parts of water. If there is a tendency to acidity, lime-water may be used to dilute the milk. It is readily prepared by roasting an oyster shell, pulverizing, and adding water, which can dissolve a limited proportion of lime, never enough to be irritating.

Chalk, being a mild antacid, is used in doses of gr. iij.–v. for children, gr. x.–xv. for adults. The officinal chalk mixture is a very popular remedy in acid diarrhœa (dose, ʒ ss.–i.). A mixture of equal parts of lime-water and olive oil makes an excellent local application for burns and for inunction of the skin in scarlet fever and small-pox. If necessary, antiseptics may be added. One of the best means for curing scabies is the following: Rub together powdered quicklime, ℥ viij., and washed sulphur, ℥ iv.; then add, stirring constantly, one gallon of boiling water. When cool, decant the clear liquid, which is to be rubbed over the *whole* surface of the body. The evaporation of the fluid leaves a fine powder on the skin, which may be washed off after an hour or so. The first general application, if thorough, is generally sufficient. There may be patches which need the local application of it. It is not irritating to the skin.

VIII. Mineral Waters.

These are remedies which constitute a class by themselves, having the properties of the organic or disease class of medicines, as they produce distinct and very pronounced changes in the body itself, and are used for chronic, not for acute forms of disease; and the properties of the eliminative class of medicines, as they increase gland secretion. Mineral waters are more particularly indicated for those diseases of advanced life dependent almost exclusively upon a disturbed portal circulation, being rarely indicated in youth, never in childhood. The portal circulation is more likely to be disturbed than any other, by reason of its receiving its sole impetus from the heart, and not being aided by muscular pressure, as occurs in other parts of the venous circulation. It is, however, aided indirectly by vigorous exercise, which increases the propulsive power of the heart; and so, among those who lead active lives, as sailors, farmers, etc., diseases for which mineral waters are beneficial, are rare, while among those who lead sedentary lives, with little or no physical exertion, they are very common. The ingestion of more nitrogenized food than the system demands may also be the cause of a disturbed portal circulation, and often these two causes are combined. A sluggish portal circulation must necessarily interfere with the functions of the liver, one of the most important of which is the separation of effete nitrogenized matter from the blood; and the imperfect discharge of this function is always indicated sooner or later by the accumulation of urates and oxalates in the blood, and by an excess of uric and oxalic acids in the urine—a condition which, if continued, induces a *gouty diathesis, biliousness, constipation, piles, slow digestion, loss of elasticity of mind,* etc., with a pulse of high tension. Not infrequently patients with these symptoms are given medicines to improve digestion, etc., and, failing to obtain relief by this treatment, they go to a mineral spring or some hydropathic establishment, where they are markedly benefited; for water itself, if taken in sufficient quantity, by increasing the fluidity and consequently the solvent power of the blood, is often an effective remedy in these cases, as the increased solvent power of the blood causes a more rapid oxidation and tissue waste in all parts of the body, and the increased fluidity greatly aids the elimination of this waste material by the kidneys. Upon this action of water the remedial properties of mineral waters principally depend, many noted medicinal springs containing nothing but pure water. The general effect of mineral waters, therefore, is to increase the waste of the system, notably of urea and other nitrogenous compounds; hence they should never be given in wasting diseases, such as *phthisis*, and in *suppurative diseases* (especially if *cancerous* or where there is a tendency to hæmorrhage), or where there is considerable exhaustion of the system, nervous or otherwise, in which they are positively mischievous;

but for certain forms of disease there is nothing to equal them, each of the different kinds of mineral waters having clearly defined uses.

Mineral waters may divided into five classes:

I. Simple saline waters.

II. Alkaline or purgative waters.

III. Sulphurous waters.

IV. Chalybeate waters.

V. Bathing waters.

I. *Simple Saline Waters.*—In these, common salt is the most abundant solid ingredient, the most valuable waters of this class being those in which the proportionate quantities of chloride of sodium and the other salts most nearly resemble those existing in human blood when deprived of its organic ingredients. Hence they possess restorative as well as eliminative properties. Common salt is absolutely necessary to the system, total deprivation producing a tendency to ulceration and epithelial disease. In addition to its other properties, it also undoubtedly aids osmosis, and upon this depends the greater part of its remedial power; for although saline waters, by diminishing the force of the heart's action, make the pulse more feeble and compressible, their principal function is to increase the chemical interchange constantly going on in the body, and, by increasing the processes of transudation, to powerfully stimulate the interstitial circulation. Hence wherever this is sluggish, and in all cases of passive venous congestion, saline waters operate very beneficially. The principal waters of this class are the Congress, Geyser, and Hathorn waters of Saratoga, and the foreign waters of Kissingen. The disorders most benefited by saline waters are:

1. *Piles:* This complaint is an indication of an extremely slow portal circulation, the hæmorrhoidal veins being the terminal ones of the portal system. Saline waters, by stimulating the portal circulation, remove the cause, and thereupon the effect disappears.

2. *Enlarged prostate gland:* Whatever causes piles will eventually cause enlarged prostate (and when this occurs in a patient over sixty years of age it is always dependent upon a slow

portal circulation), as a slow venous circulation always causes hypertrophy of connective tissue, owing to the inactive return current of the interstitial circulation. Hence saline waters are indicated to stimulate this circulation. They are also indicated for *chronic cystitis* and *weakness of the bladder*.

3. *Gynæcological ailments,* where these are dependent upon slow portal circulation, such as chronic congestion of the uterus, prolapse of the uterus, leucorrhœa, etc., and many of the troubles at the time of the menopause. If there is no wasting disease, saline waters may be given to enfeebled women.

4. *Chronic Bright's disease:* This structural degeneration of the kidneys comes on slowly, and nearly always is the result of constant irritation of the kidneys for months or years by imperfect intestinal digestion, especially of the nitrogenous elements of food. In the nephritis produced by gout, we have distinct evidence of the genesis of Bright's disease; but this disease is also caused by retrograde materials other than uric acid, many poisons being added to the circulation through imperfect intestinal digestion and other causes.[1] For instance, the coloring matter of the urine comes from the intestines, and one of the first evidences of this disease is not so much the appearance of albumin in the urine—for this is not always present—but the absence of color, with persistent low specific gravity. If taken in its early stages before nutrition begins to suffer, the further progress of this disease can often be prevented by a judicious course of mineral waters.

5. *Chronic endarteritis:* This general vascular disease, when coincident, as it almost invariably is, with Bright's disease, is caused by chronic toxæmia, partly due to the imperfect action of the kidneys, partly to imperfect intestinal digestion,[2] the latter being caused in its turn by sluggish portal circulation. There can be no better preventive of this disease than a good course of saline waters, once or twice a year, in some cases every four months.

6. *Chronic skin ailments,* when dependent upon imperfect

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[1] See article on Intestinal Fermentation, p. 27.

[2] Hence the importance of giving proper diet in this disease, fermented milk being the best form of food.

assimilation in the intestines. One very common, typical form, extremely annoying to those suffering from it, is redness of the nose, most marked after meals, and due to the formation of various acids in the intestines from the absence or diminution of the digestive secretions. Local treatment will only benefit temporarily, a course of mineral waters being indicated to permanently cure this affection. This condition also occurs in some women at the time of the menopause. All forms of *chronic eczema* dependent upon a gouty condition of the system are benefited in the same way.

7. *Chronic bronchitis,* when the result of a lithæmic condition of the blood. This form of bronchitis is often due to a family peculiarity, the gouty condition of the system manifesting itself in this form instead of chronic rheumatism or gout. At the beginning, there will be a cough, lasting only through the winter months, but it gradually encroaches on the remaining months of the year, until finally the patient has it all the time, resulting in chronic degeneration of the lung tissue, and ultimately general emphysema. Mineral waters should be given, not for the bronchitis itself, but for the bronchial irritation caused by the presence in the blood of poisonous substances.

8. *Chronic gastritis,* dependent upon interference with the return circulation from the stomach to the liver, and *chronic sore throat,* with chronic catarrh of the larynx or pharynx, are also benefited by saline waters made hot and sipped slowly, as this not only stimulates the portal circulation, but also stimulates the affected mucous membranes. If the complaint is tubercular, however, no benefit will be obtained.

As *eliminatives,* alkaline waters enter the intestine, and, owing to their affinity for the water in the intestinal secretions, they arrest the osmotic circulation between the intestines and the blood-vessels, and therefore are sure to be sent out of the system, as they do not enter the circulation, and thus act as internal enemata.[1] On this account, alkaline waters are the least prostrating of all cathartics, as they abstract nothing from the blood, produce no nausea, and so are particularly recommended for the removal of fæcal accumulations and for chronic constipation.

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[1] See also article on Saline Cathartics, p. 242.

II. *Alkaline or Purgative Waters.*—These contain, besides chloride of sodium, a considerable amount of the carbonates of sodium and magnesium and other salts. They are more prompt and energetic in their action than the saline waters, but also more debilitating to the digestive functions. The most important domestic mineral waters of this class are the Bladon Springs, California Seltzer, Perry Springs, Alkaline Springs of Wisconsin, etc.; Friedrichshalle and Hunyadi Janos being the most important foreign waters of this class. These waters are useful in the treatment of *chronic rheumatism;* and in cases of *diabetes* where patients are not losing weight. alkaline mineral waters, such as Carlsbad, sometimes do good. As eliminatives they produce considerable purgation, particularly if taken warm, the movements being painless, unaccompanied by griping, and rapidly induced.

III. *Sulphurous Waters.*—These usually contain, besides chloride of sodium, a considerable quantity of the sulphates of sodium, calcium, and magnesium; and some waters of this class also hold sulphuretted hydrogen or metallic sulphides in solution. The most important springs in this country are the hot springs of Kentucky, Michigan, and Virginia; Sharon, of New York; in England, the sulphurous waters of Harrowgate. This class is very useful in the treatment of that form of *chronic rheumatism* which attacks the joints very slowly, ultimately, however, producing permanent distortion. These and the strong alkaline waters may be combined to counteract a tendency to *chronic gout,* the patient deriving benefit in proportion as he loses weight; but if the patient is already wasting, their exhibition must be moderate. These waters must be used with a good deal of discrimination, as they produce muscular prostration which may amount to paralysis, and accordingly are contra-indicated in *fatty degeneration of the heart* and where the *arteries are atheromatous.*

IV. *Chalybeate Waters.*—These waters contain more or less salts of iron, principally the carbonate and sulphate. They are useful in those diseases for which iron is usually administered, but must be used with caution, as they very soon produce disturbances of digestion and circulation, indicative of the system being overdosed with iron. There are several domestic ferruginous springs in Pennsylvania and elsewhere, the principal ones abroad being those of Tunbridge Wells, England, and the Spa, Belgium.

V. *Bathing Waters.*—The remedial properties of baths, mineral or otherwise, have nothing whatever to do with the substances they contain. The effect of baths is to produce alkalinity of urine and other acid secretions, and to counteract the hyperacidity of the blood, and this result will follow even if the bath be of vinegar; hence warm baths are of use in the treatment of *chronic rheumatism.* Warm-water baths are always prostrating to the patient; but if salt is added, their depressing effect is to a large extent overcome.[1]

Division II.—Alteratives.

Alterative medicines, or, as they are sometimes termed, *specific* medicines, are disease medicines which are unnatural to the system. Symptom medicines are also unnatural to the system, but they are not disease medicines. Restoratives are disease medicines, but they are not unnatural to the system. Alteratives are termed specifics, not that they have the property of acting specifically against any one disease, but because their range of operation is limited. They act in an unknown way, only against certain special diseases or morbid conditions. Thus potassium iodide acts promptly against syphilitic periostitis, but not to the same degree in other forms of periostitis; colchicum is the remedy for gouty arthritis, but not for rheumatic arthritis; and so with the other remedies of this class. These medicines are not given for the symptoms of disease, but for the disease itself; for they do not relieve symptoms except by removing the disease. Being unnatural to the system, they are therefore more or less poisonous; and this fact is to be remembered, because, though all symptom medicines are also unnatural to the system, yet complete recovery from the most active of them, like opium or aconite, is a question of hours only, while recovery from the injury of organic poisons may be very slow. When the latter act as poisons they produce characteristic symptoms, such as salivation by mercury, or iodism, bromism, etc. The great rule to be observed in the administration of these medicines is that they should never produce symptoms. When they do so they cease to act as remedies, and the dose should therefore be lessened to that which does not cause symptoms, or else their use must be abandoned. Give these medicines up to the point of producing symptoms, to ascertain the dose, as, owing to personal idiosyncrasies, this may vary considerably in different patients. As their poisonous effects are both different from their remedial effects and inconsistent with them, if they are given for any length of time the danger confronts us of producing an artificial disease. An important rule, therefore, to be observed in their lengthened administration, is to conjoin restoratives with them to postpone their poisonous effects as long as possible.

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[1] See also article on Moist Heat, p. 287.

The most important medicines of this class are:

1. Mercury.
2. Iodine and compounds.
3. Bromides.
4. Arsenic.
5. Silver.
6. Zinc.
7. Copper.
8. Bismuth.
9. Colchicum.

I. **Mercury** (Hydrargyrum).

Mercury is the most typical of the specifics. Its precise action is unknown, but its use is sustained by clinical facts. Small doses have been found to increase the number of red blood corpuscles. Mercury appears to act by preventing their destruction.

Uses of Mercury.

As an Antisyphilitic.—Mercury is the only antidote against constitutional syphilis in all its stages, and the only medicine that will eradicate it from the system. The various preparations of mercury have been employed in the treatment of syphilis, calomel especially, as it is less likely to interfere with digestion. It is given in the form of powders containing one-twentieth of a grain each; two powders are taken three times per day for three days. On the third day, and every day thereafter, increase one powder until the symptoms of mercurialization occur, which, in the case of calomel, are a metallic taste in the mouth and a disagreeable fetor to the breath; this will be followed by tenderness of the gums, the teeth becoming tender and apparently longer, and, if still continued, the mouth secretes saliva, which commences to run very profusely. Salivation should never be sought for, as it produces great constitutional depression and in some cases becomes almost incurable. Therefore in giving calomel it should never be pushed beyond the metallic taste in the mouth, and as soon as this symptom makes its appearance the dose should be decreased one powder or more.

This gradual testing of the susceptibility of the patient is very important in administering calomel. When given in this manner, the patient loses the unpleasant symptoms, gains in flesh and strength, and does not show that cachectic appearance so characteristic of syphilis when fully developed. He should only be conscious of the action of the medicine by the daily improvement which he experiences. In *nocturnal syphilitic hemicrania*, one-thirtieth of a grain of calomel every fifteen minutes often gives relief when the iodide of potassium has failed.

When very rapid mercurialization is desired, inunction with mercurial ointment should be tried. The skin should be thoroughly washed with soap and water for at least ten minutes before each application. The ointment should not be allowed to remain on the skin more than twenty-four hours, and after its removal the skin should be thoroughly washed again. The amount usually employed for each application is one half a drachm to a drachm. It should be applied, by preference, on the inside of the arms, on the thighs, and on the fore part of the body, rather than the back.

The profession generally prefers the bichloride or the biniodide of mercury, as they are very reliable in their action and the least to be affected by personal idiosyncrasy. One-thirty-second of a grain of the bichloride or the biniodide is administered three times per day after meals, and the dose gradually increased to one-twenty-fourth, one-twentieth, one-sixteenth, etc., until symptoms of mercurialization appear, which, in the case of the bichloride or the biniodide, are a disagreeable odor to the breath; more commonly there is a sense of pain and constriction in the throat, and, coincident with this, in many cases there will be pain and griping in the bowels, cough accompanied with bloody expectoration, bronchitis with a tendency to bronchial hæmorrhage, and, lastly, irritation of the kidneys with blood in the urine.

Mercurial salivation produces profound constitutional prostration; this will not happen if proper treatment is adopted. In some cases of salivation, the teeth come out and necrosis of the jaw is produced. The best treatment by far is to have the mouth washed incessantly with chlorate of potash in camomile water (℥ i. of camomile flowers to a pint of cold water, and three teaspoonfuls of chlorate of potash added to it). The patient should keep washing his mouth with this, and at times swallow a small quantity of it. Along with the bad taste in the mouth, and before salivation, some persons have griping of the bowels. If they do, salivation is arrested, but the constitutional effects of mercury are lost. This is quite noticeable in chronic poisoning by corrosive sublimate, and on that account it does not always produce salivation. The dose should never be carried beyond the production of a slight fetor to the breath.

The mercurial treatment should be kept up for eighteen months to two years. When mercury is used for any length of time, it is necessary to give restoratives in order to prevent the development of any of the poisonous effects of the specific. The best for this purpose is quinine, which seems to make up the deficiency which mercury causes when given alone. Two grains of quinine should be administered in solution t. i. d. either with the mercury or after it. Cod-liver oil may also be given if there is much anæmia, but it usually interferes with digestion in syphilitic subjects. Iron is sometimes required. Alcohol is always contra-indicated in syphilis, and should only be given when necessary.

Inflammation without Suppuration.—Inflammation without suppuration may take place in any part of the body, and begins with hyperæmia, followed by an increase in the number of proper cells of the affected part and fatty degeneration, and finally by a marked increase in the connective tissue, producing *cirrhosis* if the affected part is glandular in structure, or sclerosis in the nervous system Coincident with the cirrhotic process in the organs and tissues of the body, the walls of the arteries and capillary blood-vessels become the seat of characteristic changes, consisting of chronic endarteritis, with an exudation of hyaline material on the outside of the blood-vessels. The coats of the affected vessels become very much thickened and their calibre diminished, and, in the case of the smaller arteries, the cavity is completely obliterated. This increase of connective tissue in the various organs of the body never occurs without injury to the proper cells of the part pressed upon, and as this shrinks the process goes on, and uses up what is left of the proper cells of the part inflamed, until there is ultimately nothing but a mass of fibrous tissue left.

This condition of *arterio-capillary fibrosis* is a constant companion of *chronic Bright's disease*, especially of the cirrhotic variety. This gives the hard, incompressible pulse of Bright's disease, and causes more or less derangement in the blood supply of the different organs. The diseased condition of the arteries is the commonest cause of apoplexy in Bright's disease, and interference with the circulation of the brain gives rise to certain cerebral symptoms which are the earliest indications of chronic Bright's disease and of threatening *apoplexy:* 1st. Impairment of memory, due to anæmia and malnutrition of the brain. 2d. Vertigo, especially in the morning just after rising. 3d. A persistent tendency to wake too early in the morning, sometimes with headache, which passes off soon after rising; the patient also suffers from cramps in the legs, especially in the calves, just after or before getting out of bed. 4th. A vague sense of fear, as of some impending danger. The intellect is dull and more or less impaired.

Against this very frequent cause of declining health in middle life, producing premature old age, mercury is a constitutional medicine of the highest value. This is illustrated by examination of the urine in cases of chronic nephritis. Albumin and casts are usually found, and also, a much more serious symptom, want of normal specific gravity, always low, 1.010–1 012, in this condition; the urine will also be of very light color.

The first effect of the bichloride is to bring back the natural color of the urine.

Urea is not the cause of uræmia, but it is the poison connected with the coloring matter.

The color not only improves, but the specific gravity rises; it may rise to 1.018. If these changes happen, the prognosis is generally good. Therefore, in all cases of *chronic Bright's disease, cirrhosis of the liver, chronic affections of the lungs and pleura, chronic nervous diseases, chronic endarteritis, chronic meningitis* the result of pachymeningitis or sunstroke, mercury is the remedy to be given; also in *epilepsy* traced to injuries about the head and characterized by muscular twitchings about the face and in the extremities at night. In *locomotor ataxia* and *diseases of the spinal cord*, mercury in constitutional doses should be given for a long time, one to three years if necessary. The following is useful in *chronic interstitial nephritis:*

℞ Hydrargyri Bichloridi,	gr. i.
Pulv. Digitalis,	gr. xxiv.
Pulv. Scillæ,	gr. xxiv.
Quininæ Sulph.,	gr. xxiv.

Misce et fiant pilulæ No. xxiv. Sig. One pill three times per day.

As a Symptom Medicine.—Certain preparations of mercury act as symptom or functional medicines, *i.e.*, calomel, blue pill, and mercury with chalk (for their uses and actions, *vide* Cathartics and Diuretics).

As an External Remedy, mercury is used in two classes of morbid conditions.

1. *In diseases of the skin, due to animal or vegetable parasites: scabies, favus, and inflammation of the follicles of the eyelashes.*

The citrine ointment and that of the white and red precipitate are very useful in these and other allied affections. Other forms of skin disease, though not of primary parasitic origin, are very much aggravated by the development of fungus spores, which cause decomposition of albuminoid substances with the production of acrid, irritating discharges. Thus *herpes, psoriasis, and rheumatic eczema* may become very troublesome and obstinate from this cause. The oleate of mercury can be used to advantage in *rheumatic eczema*. The citrine ointment is, for skin diseases, diluted with equal parts of zinc ointment, and five grains of salicylic acid added to the half ounce. The ointment of the white precipitate may be used in full strength.

When fibrous induration of a part results from *chronic inflammation*, the local use of mercurials is often efficacious in promoting resolution. It seems to stimulate the interstitial circulation.

If there is only passive engorgement remaining after the subsidence of inflammation, a mild preparation, such as the simple mercurial ointment, is best. But if the arteries are paralyzed, and there is a hard and shrinking exudation, the oleate of mercury is better, being a stimulant and acting as a counter-irritant. It is especially useful in *orchitis* and *epididymitis*, in *rheumatic stiffening* of the joints, and in *chronic pleurisy ;* the pleurisy in phthisis causes an exudation on the visceral surface of the pleura, and this soon communicates inflammation to the costal surface, and the two surfaces of the pleura adhere. Mercury by inunction should be employed in all cases of phthisis where pleuritic adhesions exist.

As the bases of the lungs never get well after an exudation of chronic pleurisy, so in disturbance of the intestines, after chronic peritonitis, patients will never be well for the rest of their lives. There will always be a tendency to constipation, colic, frequent loss of appetite, notably in inflammations about the uterus, the result of cellulitis, with pain on either side about the ovaries. In these cases, mercury should be used externally in the form of the oleates.

In *pericarditis*, the whole surface of the skin over the heart should be rubbed with the blue ointment, which is better for this purpose than the oleate.

2. The ointment of the red iodide of mercury is highly efficacious in the treatment of *pachymeningitis* of the brain and spinal cord, and thus holds an important place in therapeutics, because there are very few remedial measures against this most serious trouble, which very often causes epilepsy, tonic spasms, paralysis, etc. In *epilepsy* with twitching of the face and extremities during sleep, which indicate a cranial cause, viz., *chronic meningitis*, the ointment of the red iodide should be rubbed into the skull and nape of the neck. In cases of *sunstroke, meningitis following typhoid fever, pressure from inflammatory exudation, and adhesions upon the brain and spinal cord,* apply the ointment of the biniodide to the skull, the nape of the neck, and down the spine. On account of its irritating properties, it should be applied during the daytime, so as to avoid disturbing sleep. It is also a good counter-irritant. It is also used in the treatment of *enlarged thyroid gland,* or *goître.* This disease is endemic where the water is highly charged with magnesium salts. The ointment of the red iodide should be rubbed over the surface of the tumor and the patient exposed to the direct rays of the sun. One or two applications, although sometimes leading to vesication, have been sufficient in many cases to cause disappearance of the enlargement.

The metallic preparations of mercury are: Pilulæ Hydrargyri, or blue pill; Unguentum Hydrargyri, or blue ointment; Hydrargyrum cum Creta, or mercury with chalk.

The chlorides of mercury are two in number: The bichloride, or corrosive sublimate (dose, gr. $\frac{1}{32}$–$\frac{1}{20}$); its uses have already been enumerated. The subchloride, or calomel (dose, as an alterative, gr. $\frac{1}{30}$–i.; as a cathartic, gr. v.–x.).

Black wash (calomel, ʒ i.; lime-water, Oi.) is a very useful application to syphilitic skin eruptions. It can also be used to great advantage in many cases of skin disease of an indolent character with scaly surfaces; also in *pruritus pudendæ,* and in affections generally of the skin and mucous membranes accompanied by *pruritus.*

Yellow wash (corrosive sublimate, gr. xxx.; lime-water, Oi.). This lotion is very much more stimulating than the black wash, and has been used successfully in the treatment of syphilitic eruptions, condylomata, etc.; it can also be tried in pruritic affections of the skin that do not yield to other treatment.

The iodides of mercury are two in number: The biniodide or the red iodide (dose, gr. $\frac{1}{32}$–$\frac{1}{24}$). The green iodide or the protoiodide (dose, gr. $\frac{1}{4}$–$\frac{1}{2}$). This preparation is inferior to calomel in the treatment of syphilis.

The ointments of mercury are as follows:

Unguentum hydrargyri iodidi rubri, or the ointment of the red iodide of mercury.

Unguentum hydrargyri nitratis, or citrine ointment.

Unguentum hydrargyri, simple mercurial or blue ointment.

Unguentum hydrargyri ammoniati, or ointment of the white precipitate.

The oleates of mercury are made by a solution of the yellow oxide of mercury in oleic acid.

According to the strength of this solution will be its activity. A twenty-per-cent oleate is very irritating. The five-per-cent oleate is usually employed at first, and if no irritation occurs, then the ten-per-cent can be tried.

SUMMARY OF THE USES OF MERCURY.

1. As an antisyphilitic.
2. Against non-suppurative inflammations.
3. As a functional medicine. Certain preparations of mercury act as symptom medicines when given in one large dose.
4. As an external remedy, when fibrous induration of a part results from chronic inflammation; in diseases of the skin due to animal or vegetable parasites.

II. Iodine (Iodum).

Iodine is an elementary body obtained chiefly from sea weed. Its use as an elementary body in medicine is extremely limited, it being used more often in the form of a salt, *i.e.*, iodide of potassium, etc.

It is a specific, and although the least injurious of all the specifics, yet when taken in excess acts as a poison, and gives rise to a train of symptoms known as "iodism." These phenomena are coryza with frontal headache, more or less suffusion of the eyes, constriction in the throat, and sometimes salivation, gastric uneasiness, and consequent loss of appetite. If its use is continued still further, there will appear an eruption about the eyes and face, nervousness, debility, and even atrophy of mammæ and testes.

If the exhibition of iodide of potassium is continued too long and in excessive doses, gangrenous sores are apt to be formed. They first appear generally upon the legs as blisters on a reddish base; when the vesicle ruptures, it reveals a gangrenous floor, which has a tendency to extend very rapidly. As soon as this is noticed, the use of the iodide must be stopped and quinine and opium given; if no fever is present, the muriate tincture of iron may also be given. Some persons are unable to use iodine in any form, small doses affecting them very disagreeably.

When such idiosyncrasy exists, the exhibition of iodine is likely to do more harm than good.

USES OF IODINE.

1. In *scrofula:* Iodine was early used in the treatment of *scrofula* in the form of Lugol's solution (iodine, ʒ vi.; iodide of potassium, ℥ iss.; water, Oi.). This is the best way of administering iodine in all scrofulous conditions. The patient should be kept under treatment for a long time. The dose should not exceed six drops four times a day, given immediately after meals, as it is quite irritant when taken on an empty stomach; it should be well diluted with water. Its chief power lies in arresting *mucous catarrhs, inflammation* and *ulceration* of cartilaginous structures, and in hastening the resolution of *adenitis* and enlargement of lymphatics which follow disorders of mucous membranes in advanced stages of *scrofula.* These enlarged glands are usually in the neck, but in strumous girls it is not uncommon to find buboes in the groin, due to *vaginitis* and leucorrhœal discharges.

In all these conditions the solution of iodine should be given in conjunction with cod-liver oil.

The syrup of the iodide of iron and pills of the iodide of iron (Blancard's pills) can also be given; the latter are very good in conditions of *anæmia.*

2. In *syphilis, secondary* and *tertiary*, when the disease begins to attack the fibrous tissue, bones, and neuroglia and membranes of the brain and spinal cord. iodide of potassium should be given; and if the patient has not had a thorough course of mercurials, small doses of corrosive sublimate should be given with it.

For the cure of *syphilitic periostitis* and the removal of *nodes,* no remedy is so reliable as the iodide of potassium, but it should be given in combination with an opiate, in order to relieve the pain, and, although the action of the neurotic is transient and purely functional, to assist and hasten the operation of the specific, by relieving the symptoms, against the cause of which the disease medicine is directed. It is the iodide of potassium which removes a node, but when the pain caused by that node is removed by the opiate, the specific will act quicker and more certainly.

In the use of iodide of potassium in *syphilis,* the rule is that the more chronic the disease the larger the dose, and the more acute the attack the smaller the dose, as such patients are apt to be intolerant of the drug. In the treatment of *syphilitic periostitis,* ten grains of potassium iodide, in combination with ten drops of the tincture of opium and ten to fourteen drops of the fluid extract of conium, should be given every four hours. *Syphilitic periostitis* may occur in the latter stages of syphilis, and then the original doses of potassium iodide will not be enough, the absorption of inflammatory exudation being slower from interference with the collateral circulation.

Still more serious in every respect is the exudation when it occurs deeper yet, viz., within the cerebro-spinal canal. Upon the development of *syphilitic meningitis, syphilitic gummata* within the cranium or spinal cord, and in all cases of *syphilitic nervous disease,* together with *syphilitic endarteritis,* ten-grain doses of potassium iodide have little or no effect.

The drug should be carried up to the point of toleration as quickly as in the treatment by mercury. Patients in this condition can take sixty to eighty grains at a dose where formerly ten to fifteen were sufficient.

In all of those cases of chronic syphilitic disease threatening the patient with serious results on account of its location, use potassium iodide in heroic doses. Hence begin with twenty grains, then thirty, and rapidly increase the dose, watching its effects meanwhile.

It should be always remembered that as it is a disease or organic medicine, and therefore unnatural to the system, its prolonged use in these doses will produce its poisonous effects; always, therefore, give cod-liver oil and iron; if this is not well borne, quinine should be given, together with as much food as the patient can possibly take.

3. In *chronic asthma and bronchitis,* and in that form of *spasmodic asthma* which alternates with skin disease, or which, occurring in an adult, takes the place, as it were, of what would have been strumous complaints during childhood, iodide of potassium is very useful.

The potassium iodide does not relieve an attack, but it diminishes steadily the tendency to asthma in a very large proportion of cases not only of acquired but of hereditary asthma.

The patient should be kept under the influence of the drug for a long time. Four grains of the iodide of potassium, and small doses of Fowler's solution (from two to four drops), and ten drops of the tincture of belladonna, with a teaspoonful of Hoffmann's anodyne or the compound spirits of ether, should be given four times per day, largely diluted with water.

In those cases where asthma is very pronounced and allied with *bronchitis,* the treatment should sometimes be varied by giving some other preparation of iodine, and the best for this purpose is the syrup of hydriodic acid, one teaspoonful corresponding to four or five grains of the iodide of potassium.

It is not known how the iodide of potassium acts in curing asthma, except that in a very large proportion of cases it is found that patients when young have had symptoms of scrofula, sore throat, running from the nose and ears. A discharge from the nose leads to nasal catarrh, and this leads to thickening and hypertrophy of mucous membranes and submucous tissue in this part of the respiratory tract. Now, it is an important rule that derangement of any exit of canal or tube always reacts upon the nervous supply of that tract, and frequently back of it. This persistent obstruction in the respiratory tract very often leads to disorders of the mechanism of respiration, and hence asthma is acquired. Specialists have demonstrated this in many cases. As we have said, asthmatic patients in childhood were scrofulous, and hence the nasal catarrh may have developed the asthma, so that the manner in which potassium iodide acts in asthma is probably that it finds an old scrofulous tendency to deal with.

The great danger in chronic bronchitis is that the air vesicles become very much enlarged, lose their elasticity, and ultimately become nothing but passive bladders; the blood-vessels become atrophied, and therefore the right side of the heart enlarged, with consequent congestion of the liver, kidneys, etc. *Emphysema* can be prevented, and, when moderate in degree, can be recovered from, by withdrawing the obstacle in the bronchial tubes. The only remedy that is a true one, and not a mere palliative, is the iodide of potassium and the syrup of hydriodic acid, to be given in the same way as in the treatment of asthma, the two diseases being almost inseparable.

4. Iodine is useful in promoting the resolution of *exudative inflammation*, particularly in *fibrous tissue*. Unfortunately it is not so efficacious in periosteal and fibrous tissue due to other than syphilitic origin. It should be tried, however, in *rheumatic periostitis*, but the results are not always certain.

On the other hand, there are a few conditions where iodine can be used, as in tumor of the brain, where there is violent and continued headache and other indications of intercranial pressure, notably where symptoms are not febrile but due to a neoplasm. The administration of large doses of potassium iodide seems to moderate the symptoms.

It is a question whether the preparations of iodine have any power over diseases of the arteries. *Endarteritis* is one of the commonest causes of decline of health, and finally of chronic disease of the system, indicated by high arterial tension and an increase of connective tissue at the expense of higher tissues Mention has already been made of the use of corrosive sublimate in this condition, but in some cases the tincture of iodine (not potassium iodide) seems to act equally as well, and markedly so in those cases of *chronic Bright's disease with transient albuminuria, low specific gravity of the urine, absence of color,* etc. The tincture of iodine, in five to ten drop doses, well diluted in water, after meals, should be given, and many cases respond well to it.

5. The iodide of potassium is the only medicine that has any kind of testimony in its favor in the treatment of *thoracic aneurism,* or in the treatment of all *internal aneurisms* that cannot be reached by surgical means. The only recoveries (not surgical) have been when large doses of the potassium iodide have been given. Internal aneurisms of this class produce certain symptoms, due to their pressure upon adjoining nervous tissues, causing aphonia and disturbance of the larynx, characterized by cough and a peculiar croupy breathing. In all cases of this kind the iodide of potassium should be given, and frequently after a time the cough declines and the croupy breathing slowly disappears, though much later than the cough. In some cases, the aneurism stops dilating and shrinks in bulk, and in a few instances disappears altogether.

In *chronic mercurial and lead poisoning,* the potassium iodide should be given in order to facilitate the elimination of the metal. Lead forms a compound with the muscular tissues, from which it is with difficulty removed, unless by the aid of potassium iodide, which is decomposed in the body to form the soluble iodide of lead. Electricity should be used in order to restore the contractility of the muscles.

In *acute tubercular meningitis,* the only medicine which has ever done any good is the iodide of potassium.

Externally, iodine is used as a caustic and counter-irritant.

Preparations.—Potassii Iodidum; Liquor Iodi Compositus (Lugol's solution); Tinctura Iodi.

SUMMARY OF THE USES OF IODINE.

1. In scrofula.
2. In syphilis, secondary and tertiary.
3. In chronic asthma and bronchitis.
4. In exudative inflammations occurring in the fibrous tissue; in rheumatic periostitis; in cerebral tumors, with violent and continued headache and no fever; in endarteritis with high arterial tension.
5. In aneurisms of the thoracic or abdominal aorta.
6. Finally, in chronic mercurial and lead poisoning, also in tubercular meningitis.

III. The Bromides.

The bromides are recent medicines of this generation, and a very important addition to the materia medica, and, excepting quinine and opium, are used more largely than any other medicine. The action of the different bromides is so similar that they can be described under one, viz., bromide of potassium. Its medicinal power is due to its one action, that of diminishing reflex irritability by blunting the sensibility of the afferent nerves to all such impressions as would give rise to reflex action, which results in a motor phenomenon. If taken in large quantities, the bromide of potassium may arrest those reflex actions which are necessary to life. The one indication for the use of the bromides is exaggerated reflex action, whether it be due to abnormal irritability of the nervous centres or to the over-sensitiveness of the afferent fibres. In its action it is not as rapid as the neurotics, but its effects are much more permanent.

There are certain diseases which seem to depend on perversion of function or loss of equilibrium of nerve centres, aggravated and often caused by the persistent impressions conveyed by the abnormally sensitive peripheral afferent nerves, inducing paroxysms of convulsive character taking the form of tonic or clonic muscular spasms, with or without emotional disturbance. *Epilepsy* is the most noted example of this form of nervous disorders, and for the better understanding of the action of potassium bromide, which is the particular remedy to be used in this malady, a description of the disease will now be given.

Epilepsy is a disease which assumes a variety of forms, many of them unaccompanied by any severe outward systemic disturbance. But whether the external manifestations be pronounced or slight, it is always a serious disease, and many of the so-called slight attacks are ultimately as damaging in their effects as the more violent convulsive forms.

The most common form of epilepsy, characterized by severe convulsions, is that termed *epilepsia gravior*, or *le grand mal.* The attack often comes on so suddenly as to render the patient incapable of having recourse to the most rapid of all the actions of the body, viz., the instinctive movements for self-protection. Other diseases may be rapid in their development, but in none of them is the suddenness of an attack of epilepsy paralleled, and it may safely be said that, with the exception of diseases of an accidental nature, such as apoplexy, all diseases very sudden in their onset are epileptic. In many cases, there are premonitions varying in duration from five minutes to several hours. The most common of these preliminary sensations are termed auræ. They are varied in their nature and occur in all parts of the body. Sometimes there will be a peculiar sensation in the epigastrium, proceeding towards the brain, vaguely described by the patient as a breath of cold air; or there may be a modification of some one of the special senses or of some function connected with them. The patient sees curious sights—visual aura; or hears unusual sounds—aural aura; or the aura may consist of a peculiar taste or smell; or there may be aphasia; or, more strangely yet, the aura may be purely intellectual, curious ideas passing through the mind. All of these auræ are a part of the epilepsy itself, and not simply the precursors of it. It is well to bear this in mind, for in many cases, after the continuance of the convulsive attacks has been broken by the use of the bromides, the occasional visitation of one of these auræ is sometimes looked upon as an insignificant symptom—an erroneous idea, for this is an indication that the disease is still present, although in a latent form, and, unless appropriate remedies are used, the severe convulsions of the disease will reappear.

Patients, therefore, should not be led to expect entire freedom from attacks of epilepsy until there have been no manifestations of auræ for two years.

A large number of these attacks commence by the patient emitting a dreadful, unearthly cry (caused by a sudden cramp of the diaphragm and of the muscles of the larynx), so peculiarly disagreeable in its nature as to frequently affect the domestic animals. This cry, whenever it occurs, is of itself an unmistakable sign of the disease. Along with this it is very common to have the jaws suddenly clenched, and, owing to its getting between the teeth, the tongue is not infrequently bitten. This is a valuable diagnostic sign, especially in those cases where the patient has attacks during the night of which he is unconscious, or where he imagines that he has only had a fainting fit; for whenever the tongue has been bitten, there has been severe convulsive epilepsy. A form of this disease, called the Jacksonian, always begins in a certain group of muscles, from whence the convulsions develop. There is generally pallor of countenance, but on account of the muscles of the neck, from their violent contraction, pressing upon the great veins of the neck, this is rapidly followed by turgescence. Respiration for the same reason sometimes becomes of a gasping character, giving the appearance of strangulation; and the eyes, when they are not performing irregular movements, are turned upward. Occasionally, in these cases, the sphincter muscles are in a state of relaxation—not on account of the violent muscular movements, for it sometimes happens in slight attacks—and the patient passes urine and fæces. If, therefore, from the time he was a child, a patient had not, till recently, suffered from nocturnal incontinence of urine, it is quite probable he has epileptic attacks during the night.

Gradually, during the course of an attack, the convulsions cease, the patient passes into a state of coma with stertorous breathing, and finally returns to consciousness with a feeling of exhaustion and usually with some expression of surprise.

So much for the convulsive form, regarded by many as the only true form of epilepsy; but unfortunately this malady may occur without any convulsions whatever, and, therefore, it is not correct to define it as a convulsive disease. Thus a very common form is where there is only a slight pallor of the countenance, the patient rarely falls, never suddenly, the other symptoms are all slight, and he soon recovers from the attack, a little depressed and often with a tendency to excessive micturition. This is called *epilepsia mitior*, or *le petit mal;* but it is not mild or slight, as its name suggests, as, on the whole, it has a more destructive effect upon the mental powers than the violently convulsive form. In another form of the disease the patient does not lose consciousness; again in others, instead of falling, he performs many actions which seem to imply that he is in command of voluntary movements. This is so only in a limited sense, for his actions resemble those of a somnambulist. This form is called *co-ordinate epilepsy.* The attacks are very sudden in their onset, and are truly epileptic; for attacks of *le petit mal* and of co-ordinate epilepsy frequently alternate with convulsive attacks. Another variety is where the patient, after the attack, which may or may not have been violently convulsive, is seized with a furious homicidal mania of which he subsequently remembers nothing.

The definition of epilepsy may now be considered. It cannot be defined as a convulsive disease, for many patients with this malady have no convulsions ; nor as a disease in which the patients fall, for in some forms they walk about during the seizure; nor as a disease characterized by total loss of consciousness, for this does not always happen, the patients sometimes going through very complicated intellectual processes; nor as a disease which abolishes either the motor or sensory powers of the body. What, then, is the definition ? *Epilepsy is a disease characterized by sudden, transient, recurrent loss of function on the part of one or more cerebral centres, which loss of function deranges other nerve functions dependent upon it or them.*

Some writers, from observing the manner in which the convulsions of epilepsy radiate, say they are due to over-stimulation or over-excitation of the motor centres in the cortex of the brain. But they may be explained on quite another principle important to understand, for upon its thorough comprehension depends the correct treatment of the disease. In these convulsions, we have an illustration of the fact that no nerve centres ever act independently. For the beautiful co-ordination of the various movements of the body, all the nerve centres are related to each other and made mutually dependent. Normally, all movements are proofs of regulated discipline, no centre acting before the others are ready. The sudden arrest or derangement of the function of any one of them disturbs the ordinary *interaction* and suspends or deranges the functions of the others. For illustration, what happens when a steamship is violently shaken from stem to stern on account of the screw having been lifted out of the water by a large wave? Has the screw been over-stimulated? No. The shaking was caused by the screw being withdrawn from the force against which it usually acted. In like manner, if the motor impulses are removed from the control of the inhibitory centres of the brain, convulsions follow. Or, to take another illustration, upon the mutual pressure of the stones of an arch depends the integrity of the arch itself. Suddenly remove one of the stones upon which the others depend, and the whole comes down with a crash. Have these stones been stimulated or over-excited? No. So with convulsions. They are due, not to over-stimulation of the centres, but, as already stated, to disturbance of their ordinary mutual interaction.

Nervous action, unless originated by the will, never occurs spontaneously, but always depends on some afferent impression which elicits it. Epilepsy is consequently invariably due to derangement of the nerve centres caused by unaccustomed afferent impressions being transmitted to them which lead them to act irregularly. If the derangement occurs in the motor centres, there will be convulsions; if in the intellectual centres, there will be intellectual disturbance but no convulsions; if the automatic centres are affected, they will be withdrawn from the control of the intellect, and the actions of the patient will then resemble those of a somnambulist. It is very dangerous, therefore, to create new impressions in any part of the body, for they may occasion epilepsy. For instance, the washing of the thoracic cavity in cases of suppurative pleuritic effusion has given rise to epileptic convulsions, in some cases so uncontrollable, even by chloroform, as to terminate fatally. The most careful autopsies have failed to discover any lesion in the brain or spinal cord, so these curious cases of epilepsy must be due to unaccustomed surface impressions[1] deranging the nerve centres. From what has been said it necessarily follows that in the treatment of epilepsy careful search should always be made for abnormal surface impressions, and every effort be made to remove them. Often this afferent irritation is from within the cranium itself, *e.g.*, meningeal irritation, occasioning twitching of the facial muscles, especially during the night, and the attacks invariably commencing in the same way. Remove the cause of the irritation by trephining. Or the same symptoms may be due to malformation of the skull causing adhesions, which should be removed by corrosive sublimate. Intestinal or stomachic irritations are also frequent causes of epilepsy, and so is the rapid swallowing of food, the incessant action of the epiglottis irritating the nerve centres. Wherever the irritation is situated, in the nose, eyes, bowels, genito-urinary tract, or elsewhere, it must be removed before the disease can be effectually dealt with.

Treatment of Epilepsy.—The greater proportion of the ordinary movements of the body are excellent illustrations of the excito-motor function of the nerve centres. As an example we may take the act of winking, which usually is purely reflex. This action can be prevented in three ways: (1) by severing the branches of the fifth nerve which convey the sensory stimulus calling for the act of winking to the nerve centres; (2) by paralyzing or blunting the sensibility of the nerve centres by a neurotic; (3) by severing the branches of the seventh nerve governing the muscles which move the eyelids up and down. Now, the bromides have the remarkable property of paralyzing peripheral sensations. A patient, therefore, under the influence of these drugs, of which potassium bromide is by far the most important, has a peculiarly dull, meaningless stare, because those peripheral impressions which lead to reflex action have been paralyzed, and therefore the patient does not wink, because no stimulus to do so reaches the nerve centres. It is doubtless to this property that potassium bromide owes its efficacy in the treatment of epilepsy, for it paralyzes those peripheral irritations leading to the convulsions and other manifestations of this disease. But it is as if we were watering a small garden-bed by turning a whole river upon it; for, in giving potassium bromide to prevent epilepsy, necessarily the greater part of the normal reflex excitability of the body is also lessened. If given in excess, the patient has no vivacity, he is slow and staggering in gait, and his movements generally are sluggish because the brain is not receiving the proper stimuli; the memory also is impaired, though the mind is never permanently affected by the use of the bromides; the blood is impoverished, and there is a tendency to œdema and to hæmorrhagic extravasation under the skin; an acne-like eruption of very disfiguring pimples appears on the forehead and elsewhere. There will also be salivation. If these symptoms are allowed to continue, the epilepsy returns in a more incurable and obstinate form than originally. But this need not happen, for if given carefully the bromides may be continuously administered for three or four years to stave off the attacks of epilepsy, without causing any permanent injury to the patient's health. As concentrated solutions of potassium bromide are very irritating to the stomach and apt to cause gastritis, with consequent disturbance of appetite, which is by all means to be avoided in this disease, the drug should always be freely diluted with water, and the stomach should contain sufficient food to cause a flow of the secretions. A little milk may therefore be given with the bromide. Cod-liver oil should always be given, as it is the great preventive of the injurious effects of the bromide, and with it some preparation of phosphorus, *e.g.*, syrup of hypophosphites acidulated with phosphoric acid. This is an excellent adjuvant, especially for preventing the acne. (Where this last symptom is severe, give at the same time small doses of Fowler's solution, and, to free the secretions of the sebaceous glands, have the skin well washed with tar soap and warm water.) Moreover, as the action of every constitutional medicine is assisted by combining with it a symptom medicine, neurotics which deal exclusively with symptoms of disease may be administered, as for a short time they also are paralyzers of reflex action. The best for this purpose is *chloral*, which has much the same action as the bromides. Another adjuvant which may be given is *alcohol*. As a rule it is not very desirable to give this to epileptics, but in certain cases it does a great deal of good, especially where, as in nocturnal cases, the attack comes on at a particular time in the twenty-four hours. If the attacks are always nocturnal, Hoffmann's anodyne may also be added. If the attacks occur in the early morning, they are caused by the emptiness of the stomach. Give the patient food just before the expected attack, and with it administer the medicine. This treatment will break up the systemic habit engendered by a long continuance of the disease.

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[1] The pleural nerves in a closed cavity never felt the sensation of washing. Similar fatal attacks of epileptic convulsions have followed washing out the stomach.

℞ Kal. Bromidi, ...	ʒ iv.
Chloral, ...	ʒ iss.
Spts. Frumenti, ...	℥ iv.
Aquæ, ...	ad ℥ vi.

M.

Dose, tablespoonful t. i. d., in half-tumblerful of water. If the patient has nocturnal attacks, give half-dose in forenoon, half-dose in afternoon, and double the dose at night; and if the attacks are always nocturnal, add ʒ i. of Hoffmann's anodyne.

Potassium bromide is more successful in those cases subject to severe convulsive attacks than where this is not the case. The great majority of the former class of cases can be cured by this remedy properly administered with its adjuvants, but it is not so efficacious where the external manifestations of the disease are not so pronounced. However, in all cases of epilepsy give the bromides in one form or another, and remember that the disturbing afferent impression is to be remedied. At the same time with the use of bromide of potassium in epilepsy, attention must be paid to the diet. The pyloric sphincter of the stomach is relaxed or semi-paralyzed, and food rapidly passes into the small intestines, which are also in a relaxed condition; this condition causes the ravenous appetite of the patient, and the tendency to "bolt" his food without properly masticating it. Animal food aggravates this condition, and should be prohibited; but if any is taken, it should be in the morning and not at night. Fish, milk, and eggs may be allowed.

The Bromides in other Diseases.—Nervous irritation proceeding from the pelvic viscera, particularly from the genito-urinary tract. produces an extremely depressing effect upon the system, the patients having an impression of impending evil. A clean, incised wound in the perineum, of only an inch in length, often seems to cause more shock to the system than the amputation of a limb. Not infrequently, from the extreme depression of the heart, there will be cardiac vomiting and uncontrollable nausea—a grave sign of speedy dissolution. If any disturbance occurs in the pelvic viscera, the abdominal viscera sympathize, as shown by the normal function of pregnancy causing nausea and vomiting. For all troubles due to pelvic irritation the bromides are to be given as sedatives, and hence are to be used for any nervous condition caused by *irritation of the bladder, uterus*, or *ovaries*, for *spermatorrhœa*, etc., and, as a stimulant adjuvant, alcohol or ammonia should be combined with them. In *hysteria, hypochondriasis*, etc., the bromides may also be given, not steadily, but simply to lessen the nervousness. Bromide of sodium (dose, gr. xxx.) often answers as well as the bromide of potassium (dose, gr. xv.) for this purpose. Occasionally pelvic disturbances give rise to what gynæcologists term a *uterine cough*—a loud, barking, non-expectorant cough, occurring whenever the patient is excited. For this trouble bromide of ammonium answers very well indeed, as it has an effect on the bronchial nerves peculiar to itself, and on this account it is also useful in *whooping-cough*.

In *tetanus*, the spinal cord is in such an irritable condition that the smallest irritation, as a puff of cool air or touch to the skin, will induce generalized and violent muscular spasm out of all proportion to the exciting cause. Bromide of potassium has been used in this disease with good results, but its exact value has not been determined.

During the *first dentition* the irritation which is set up by the tooth which is coming through gives rise to reflex pain in the ear and to suppression of gastric and intestinal secretions, and secondarily to acid vomiting and diarrhœa (due to fermentation), and sometimes *convulsions*. In a majority of cases this reflex action is due to the pressure of the tooth on the jawbone, and consequently the lancing of the gums should not be resorted to unless there is unusual swelling and tension. Bromide of potassium should be given, not to relieve the pain of the tooth, but to overcome the reflex irritability, and, by removing the cause of the suppression of gastro-intestinal secretions, arrest the vomiting and diarrhœa (dose in these cases, gr. v.–vii.).

In health, there is a physiological association between the movements of the stomach and rectum, due to reflex action of the muscular coats of one upon the other. Thus, when food is taken into the stomach, there is a tendency for the rectum to discharge its contents, and, at the same time with the discharge of its contents, for the partially digested food to pass through the pyloric end of the stomach.

In *chronic dysentery*, this reflex action is abnormal. The mere taking of a small quantity of food into the stomach causes the rectum to act, and the undigested food passes through the pyloric end of the stomach and rapidly through the small intestines, and in the stools there is present the odor of the food. This interferes greatly with nutrition, and causes emaciation, especially in children. The indication in *dysentery* is to blunt the sensibility of the afferent nerves of the rectum, and so prevent paralysis of the pyloric end of the stomach. If the stomach will not bear the necessarily large doses, it may be given in enema per rectum, combined with laudanum. It may be given by the mouth, if it does not derange the stomach.

It is often difficult to make a laryngoscopic examination on account of the persistent gagging of the throat, and sometimes vomiting, which ensues whenever the uvula or the walls of the throat are touched. This reflex action can be overcome by administering thirty grains of the bromide half an hour before the examination.

The bromides, by blunting the sensory impressions and thus allaying nervous irritability, act indirectly as soporifics; for many cases of *insomnia* are due to irritability of the surface nerves from over-fatigue, mental or physical, as in women after parturition. Alcohol, ether, and Hoffmann's anodyne greatly assist the soporific effect of the bromides.

Dysmenorrhœa, attended with headache and other disturbances, is often relieved by the use of the bromides, and by placing the feet in hot water.

Preparations.—The bromides commonly used are those of potassium, sodium, ammonium, and lithium.

The bromide of potassium is the most effective as a reflex paralyzer; next, the bromide of lithium; and lastly, that of ammonium.

Fifteen grains of the bromide of potassium will produce the same effect as thirty grains of the bromide of sodium or ammonium.

The disadvantages of bromide of potassium are that it produces *bromism* much sooner than the other salts; it is more depressing on the heart than the bromide of sodium, which can be taken for a longer time.

The bromide of potassium, being taken up by the red blood-corpuscles, is apt to cause anæmia when given in excess or for too long a time. The bromide of sodium is found only in the liquor sanguinis, and is to be preferred in the treatment of delicate women. In *epilepsy*, the bromide of potassium acts much better than the other salts, and is the only one that should be given.

It should be given in large doses until symptoms of bromism appear, and the amount which just falls short of producing these symptoms is to be taken as the dose and given three times a day. Some patients require forty grains, others sixty, others ninety. The last quantity is usually well borne in severe cases. Small doses are of no account.

IV. **Arsenic** (Arsenium).

Arsenic ranks among the most virulent of all poisons, being very similar in its local and constitutional action to corrosive sublimate, and characterized, like the latter, by producing fatty degeneration, beginning with the glandular and extending to the muscular tissues of the body. Particularly will there be fatty degeneration of the liver and kidneys where there is chronic arsenical poisoning. These two organs show their degenerative processes together. It also attacks, by the same morbid process, the peripheral nerves, producing arsenical paralysis. The central nervous system, as a rule, is not involved, although in many cases the symptoms closely resemble those of central paralysis. Mercury and phosphorus also produce fatty degeneration. Phosphorus should not be administered without some caution. Its continued administration leads to a form of jaundice which may become serious, the disease not only being functional but textural. Phosphorus should be given with more caution than any other of the restoratives. The latter are natural to the system, and an excess is merely overfeeding the patient; but with phosphorus its natural form is not the same as when taken into the system in the food, and it acts in the same way as mercury, arsenic, and antimony. All of these medicines, in small doses, have a singular effect upon the blood, apparently increasing the red blood-corpuscles. It is not believed that they increase their formation, but prevent their destruction and elimination.

1. *As an Antiperiodic.*—In *pernicious anæmia*, there is a steady decrease of the red blood-corpuscles. This disease is peculiar in its character, and not to be confounded with anæmia of other diseases. It has lately been shown that in this disease there is a great accumulation of iron in the liver, due to the destruction of the red blood-corpuscles, which leave behind them their iron.

This destruction occurs in the portal circulation, and therefore is not due to changes throughout the system. In pernicious anæmia, no medicine that increases the formation of red blood-globules has any effect. Arsenic delays their destruction and is effective. It can also be given to prevent the destruction of the red blood-corpuscles in malarial disease of the liver, and where the liver is deranged owing to the poisonous effects of sewer gas. This resembles malaria, except that there is no decided periodicity, although there are all the other symptoms of malaria.

Arsenic has long been employed in the treatment of malaria, and where quinine fails it ought to be used.

It operates in an entirely different manner from quinine. The latter is generally employed during interfebrile times. Arsenic can be administered at all times without reference to when the disease comes and goes, and can be given three or four times a day. In the treatment of intermittent fever, it should be given up to the point of producing a slight nausea, but should not be given too long.

Fowler's solution (the most definite way of administering arsenic) can be given in doses of from six to twelve drops three times a day, and in some cases more, with this result: if the patient improves, he remains well for a longer time than when treated by quinine. No case, however, of ague gets well under twenty-eight days; but it can be eradicated apparently better by arsenic than by quinine, owing probably to the former being a better germicide than the carbolic-acid class. Relapses in malarial fever are the exception after having been treated by arsenic. The French army have adopted this treatment for intermittent fever in certain parts of the sea coast of Algiers. One drop of Fowler's solution is given every fifteen minutes, and when this produces nausea it is given per rectum. It is claimed that this is more successful than the treatment by quinine. This is probable, as the fever interferes with absorption of quinine, the portal circulation being so slow that it has very slight absorptive powers, and, as a result, a large quantity of the quinine is lost. Arsenic is also used in cases of chronic malaria, where quinine has been tried without success; notably successful in cases of neuralgia and headaches of malarial origin. To be successful it must be given for a long time (three to six weeks). When it breaks up the paroxysms of ague, it does not do so at once; the patient will keep on having chills, but each time they will be less severe, much shorter, no sweating, and so gradually decline until there is no fever at all. Quinine, on the other hand, to succeed, must totally abolish the paroxysms. If they recur, no good can be expected from quinine.

2. Arsenic is also a great remedy for *irritative conditions of the stomach*, when there is *vomiting* due to *gastritis* of a chronic kind, as of drunkards, and vomiting due to any obstinate cause except a cerebral one. Arsenic may be given in small doses, one-half to one drop of Fowler's solution, no more. This works like a charm. Also in the *vomiting of pregnancy* the same doses should be used. Sometimes one drop doses of the tincture of

iodine are equally successful in the treatment of vomiting when due to the stomach itself or in pregnancy.

Arsenic, though difficult to explain how, acts as a specific in *gastralgia*. Many forms of this complaint are characterized by sudden violent attacks of pain, producing deathly faintness, without signs of inflammation, gastric ulcer, or peritonitis, and will recur periodically once or twice a year. It is due to some derangement of the sympathetic system of nerves, similar to *enteralgia*, which attacks the flanks on either side, and evidently is located in the abdominal plexus. Sometimes there are also pains in other parts of the body that raise suspicion of locomotor ataxia, and sometimes they are the premonitory symptoms of that disease. For these attacks, arsenic is the remedy. It is best given in the form of arsenious acid (dose, gr. $\frac{1}{20}$), in pill form with the extract of gentian, repeated every hour.

3. *In Chronic Diseases of the Skin.*—Organic or disease medicines are not beneficial in acute diseases, so arsenic is not to be used, as it almost invariably aggravates skin diseases of an acute character. The case must have lasted at least six weeks before beginning the treatment by arsenic. It must not be given in an acute disease, nor in acute exacerbation of a chronic disease. Arsenic is *the* remedy for scaly skin diseases, *psoriasis, lepra,* etc., which are very serious skin diseases and are often hereditary. They are relieved by arsenic and one other medicine which should always be combined with it—liquor potassæ. It ranks about equal to arsenic in chronic skin diseases, particularly scaly ones. In the treatment of those diseases, arsenic can be given for weeks and weeks, carefully looking out for symptoms, and along with it liquor potassæ should be given; sometimes the arsenic can be dropped, and reliance wholly placed upon the liquor potassæ. In these cases, large doses of the liquor potassæ can be given, though patients vary remarkably as to the dose they can take—as a rule one-half drachm of the liquor potassæ and an equal amount of the elixir cinchonæ to be taken one hour after each meal; then increase to one drachm, then to a drachm and a half and up to two drachms, and some authorities recommend six or seven drachms at a dose. It should be diluted with a considerable amount of water. This is a great adjuvant to arsenic, and

particularly good in many forms of skin diseases where arsenic does not do good alone, as in eczematous cases.

4. Along with scaly skin diseases, there will be trouble with mucous membranes, as might naturally be expected. In these cases, there will be a tendency to *asthma* and alternate *bronchitis, chronic bronchitis,* and *chronic emphysema.* There are only two remedies for this trouble, iodine and arsenic, so that in every case of asthma the treatment should be with arsenic and iodide of potassium, and give belladonna as an adjuvant. The following will be found useful in hay asthma, and should be given for two months before the expected attack, which usually takes place, in New York City, on August 20th:

℞ Liquoris Potassii Arsenitis, ...	ʒ vi.
Tincturæ Belladonnæ, ...	q. s. ad ℥ iij.

M. Sig. Begin with nine drops in water one hour after meals; after a week increase to twelve, after another week to sixteen, and after another to twenty, provided there are no symptoms of poisoning by arsenic developing.

This course of treatment should be commenced about June 1st and continue to August and up to the time for development of the disease.

In the first year there will be less of the asthma, in the second year very little if any, and the third year is sufficient to break up the constitutional tendency to this trouble. Arsenic should be given in chronic bronchitis and in cases of ordinary asthma in the same way as recommended for slow diseases, with the help of a certain class of restoratives to be mentioned later on. Another condition with a tendency to asthma often occurs in women, viz., *dysmenorrhœa,* particularly in families subject to these scaly skin affections. Arsenic is of great service in dysmenorrhœa, inducing a more healthy condition of the mucous membrane of the cervix uteri, and in preventing spasmodic action and closure of the canal by the mucous membrane. Other forms of dysmenorrhœa are not benefited by arsenic.

5. *Chorea* is a disease dependent upon the rheumatic poison acting in that form in early life, and, like rheumatism, gets well of its own accord. This is a serious complaint, having a tendency to produce heart disease, and leaving behind it weak-

ness of the nervous system. Arsenic should be given in full doses, children being able to bear it better than adults.

In *eczematous diseases of the skin,* arsenic is good, but not so markedly as in scaly affections. In papillary diseases, as *acne,* arsenic is quite inferior in its effects to those produced in the other two classes of skin diseases already named. Nevertheless it is still used in the common form of acne, where the small papules are not much inflamed, but should not be used where there is inflammation and a tendency to the formation of small boils, local treatment being better here. This disease, in some cases, is very disfiguring. There is a very close relation between acne and irritation of the genito-urinary tract, therefore hot-water vaginal injections, with a little borax and peppermint or menthol, should be used. This acne may also occur in young men, not dependent at all upon anything immoral. These cases should be treated by passing a cold sound through the urethra into the bladder. The sound should be thoroughly disinfected, and passed twice a week.

Toxicology.—The medicinal and the poisonous doses of arsenic differ widely. The first symptom noticed is a sense of weight and discomfort in the epigastrium, very much resembling gastritis, then pronounced nausea; intestinal disturbances, with griping, which may or may not be accompanied by slight looseness of the bowels. After this commence the constitutional symptoms, first manifested about the eyelids, which become swollen and puffy, and are more or less stiff when closed or opened. Then a sense of numbness and tingling, most pronounced at the tips of the fingers, owing to the beginning of fatty degeneration in the peripheral nerves. This may also involve the tongue and the lips. Lastly, a sense of faintness. The heart begins to beat feebly, and in some cases there are attacks of syncope. The medicine must be stopped or the dose diminished at the first symptom of gastritis and nausea. When numbness and tingling, with swelling of the face, are present, the medicine should be given up altogether or the dose greatly diminished. Where no symptoms are present, it is quite certain that no harm is being done, although continued for several weeks or months together.

The chemical antidotes to arsenic are freshly prepared hydrated sesquioxide of iron and magnesia freshly calcined.

Preparations.—Acidum Arseniosi (dose, gr. $\frac{1}{30}-\frac{1}{24}$). Liquor Potassii Arsenitis, or Fowler's solution (dose, usually about gtt. iv.). Liquor Arsenici Hydrochlorici (or the Liquor Acidi Arseniosi); this preparation is very well borne by the stomach (dose, gtt. iij.–vi.). Clement's Solution of the Bromide of Arsenic (dose, gtt. iij.).

This last preparation is very powerful, and is recommended in the treatment of diabetes. It answers admirably in diminishing the sugar, and also gives muscular strength to the patient, great weakness being one of the chief symptoms of this disease.

SUMMARY OF THE USES OF ARSENIC.

1. As an antiperiodic.
2. In chronic gastritis and gastralgia.
3. In chronic skin diseases of a scaly nature, combined with liquor potassæ.
4. In asthma, chronic bronchitis, chronic emphysema, and hay asthma.
5. In chorea.
6. For dysmenorrhœa occurring in women who are subject to scaly skin diseases, also in acne where there is no tendency to inflammation.

V. Silver.

This substance is used in medicine principally in the form of the nitrate, the most convenient and best preparation. As it is an organic medicine, any disease benefited by it is a serious one. It is particularly effective in those nervous disorders dependent upon organic disease of some part of the nervous tract, giving rise to violent neuralgic pains, which are sooner or later followed by local anæsthesia. A typical disease of this kind is *locomotor ataxia,* the most protean of all nervous disorders in its manifestations. In some cases, it begins in disturbance of the bladder, or with violent pains in the bowels or side, more commonly in the left side, and referred, perhaps, to the region of the heart;

other patients lose their voices and have a peculiar sensation about the larynx from involvement of the laryngeal nerves, while others may have nothing else for years but intermittent attacks of vomiting and prostration, with perhaps palpitation of the heart. The vomiting induced by this disease may be known by the absence of the local symptoms of tenderness, tumefaction, sense of heaviness and pain, and by the diminished or absent tendon reflex and permanent contraction of the pupils of the eye. Fulminating pains are also characteristic of this disease, indicating that it is organic and leading to sclerotic change. Nitrate of silver relieves these pains better than the anodynes, and for the time apparently cures the disease. It should be given intermittently, as the long-continued use of this drug produces a ghastly discoloration of the skin. The pains of *angina pectoris*, probably due to degenerative changes in the intercardiac ganglia, are also occasionally relieved by the nitrate of silver. Before the introduction of the bromides, it was the favorite remedy with many physicians for *epilepsy;* and where this is dependent upon constant organic irritation, it may still be given with some benefit, notably in epilepsy accompanied by severe headache. A dose of one-quarter grain an hour after each meal may safely be given for six weeks, when its use should be discontinued for a similar period, or even longer, and then given again. This substance is also a very powerful astringent, and hence is one of the best remedies in the treatment of *chronic dysentery.* It should be combined for this purpose with a substance that does not dissolve readily.

℞ Argenti Nitratis,	gr. ¼.
Pulveris Opii,	gr. ¼.
Terebinthinæ Resinæ,	gr. ix.
Bismuthi Carbonatis,	gr. ij.

M. et ft. pil. No. iii.

(If nitrate of silver cannot be taken, sulphate of copper may be substituted.) Its use has also been recommended in *pachymeningitis, myelitis, paralysis agitans,* and those forms of *vasomotor depressions* characterized by violent palpitations, frequent flushings, and perhaps permanent dilatation of the arteries of certain parts, in consequence of derangement of the cardioinhibitory mechanism, and of the centres which control the calibre of the arteries. This condition is met with in some forms of *Graves' disease* or *exophthalmic goitre,*[1] though it may exist independent of thyroid hypertrophy. (For the uses of nitrate of silver as a caustic, see p. 268.)

VI. Zinc.

This substance, when given as a medicine, is generally administered in the form of the oxide. Its use is restricted to nervous disorders, particularly to two, *chorea* and *muscular tremors.* In chorea, the larger the dose the more quick and effective will be the result. Small doses are useless. Commence with two-grain doses of the oxide in pill form, three times a day, and gradually increase until the dose is five grains. If the patient can take the latter amount, the chorea will be relieved in a week. If no effects are shown, its use may as well be discontinued. It may be given until there are symptoms of dyspepsia, nausea, and the patient has a metallic taste in the mouth. The oxide is to be preferred to the sulphate of zinc, as the latter gives rise to nausea in doses larger than three grains, while the former does not.

Tremors are of two kinds: (1) those caused by muscular exhaustion, as from carrying loads that are too heavy; (2) those due to positive organic mischief in the peripheral nerves or in the nerve centres. If the cause is in the nerve centres, as in *paralysis agitans,* exertion of the will can temporarily stop the tremors; if the cause is peripheral, exertion of the will increases the tremors. Zinc oxide very decidedly diminishes peripheral tremors, which most commonly are dependent upon *alcoholismus* or caused by *mercurial* or *arsenical poisoning.* It may be given, therefore, to counteract the effects of a drunken debauch, as shown in tremor of hands, etc. On account of its soporific properties it is also a good remedy for the *insomnia* of *delirium tremens,* and in those cases bordering on it from inability to sleep (dose. gr. iij. t. i. d.). It may also be given to relieve the depression caused by the withdrawal of alcohol from the patient. For this purpose combine with it one-fourth grain of extract of belladonna. Lastly, zinc is of use to check excessive secretion from bronchial mucous membrane, as in *bronchorrhœa, chronic bronchitis, phthisis,* etc. It should not be given if the secretion is purulent, as zinc seems to enter into chemical combination with the pus, giving an excessively fœtid odor to the breath. It also diminishes the coughing by lessening the susceptibility to irritation which causes the cough. Full doses should be given three or four times a day. It is not to be recommended for *whooping-cough.*

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[1] For the palpitation of the heart in this disease, strophanthus should be given.

VII. Copper.

Sulphate of copper has been given for the relief of epilepsy, but it is doubtful if it has any beneficial effect when so used. Occasionally it may be substituted for nitrate of silver in the treatment of *chronic dysentery,* its principal use being as a local astringent.[1]

VIII. Bismuth.[2]

This substance is not an ingredient of the system, is very insoluble, and its action may be only local, though in its effects it appears to be a specific. It is an excellent remedy for intestinal fermentation, and is, in this way, a preventive of *gastrodynia, sick headache, dyspepsia, borborygmus, etc.* It controls the diarrhœa of *typhoid fever* and *chronic phthisis* (dose, five to thirty grains).

IX. Colchicum (Meadow Saffron).

Colchicum is the only vegetable substance known which acts as an alterative or specific medicine. Its effects are analogous to those of mercury, iron, arsenic, and the bromides, and in overdoses it causes very disastrous and permanent changes in the tissues and nutritive processes of the body; the blood is impoverished and very difficult to restore to its normal condition;

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[1] For the astringent uses of copper, see p. 269.

[2] See also Disinfectants, p. 39, and Constipation, p. 225.

there is fatty degeneration of the liver, ruinous alteration of the gastric mucous membranes, and loss of hair, nails, and teeth. Hence colchicum may be termed a constitutional poison.

Colchicum is the specific medicine for *gout* in all its varied manifestations. Why it is so cannot be explained any more than we can tell why mercury is the specific for syphilis, except from clinical experience. Gout is a disease dependent upon the presence in the blood of uric acid and combinations of this substance with different alkalies, such as sodium, etc. The excess of urates in the system is probably due to the lack of oxidizing power on the part of the liver to convert the whole of the retrograde substances of the body into urea, part being formed instead into uric acid, which in excess enters into combination with other substances to form urates. It is difficult for the system to eliminate these insoluble substances, so they circulate in the blood, and finally are deposited in those places where the circulation is poorest—*e.g.*, around the joints—and cause local irritation. As the treatment of this disease is essentially different from that of rheumatism, with which gout is sometimes confounded, it is necessary to thoroughly understand its nature, for the detection of a gouty diathesis will throw a flood of light on a multitude of bewildering symptoms otherwise inexplicable. A gouty condition does not always show itself in inflammation of the joints. In women especially, it may appear in the form of *sore eyes*, or as *bronchitis* characterized by violent coughing with a non-purulent expectoration, or there may be severe attacks of *dyspepsia, diarrhœa,* or *dysentery*, or, what is very commonly the case, the patient may have violent *neuralgic* pains about the head and face. Moreover, if one manifestation of the disease be made to disappear, it will frequently show itself in another form. If the patient does not suffer from Bright's disease, an incompressible pulse will generally furnish the clue for the detection of gout. One infallible sign of a gouty constitution, when found, is the presence of little, bead-like deposits in the cartilages of the ears.

The principal points for the differential diagnosis of acute gout and acute rheumatism are as follows:

Acute gout.	*Acute rheumatism.*
1. History of high living or inherited tendency.	1. History of exposure to wet or cold.
2. The smaller arteries, irritated by the circulation in the blood of the insoluble poisons causing the disease, contract, obstructing the course of the blood through the larger arteries, and thus give a full, incompressible pulse.	2. The poison circulating in the system is soluble, causes no irritation, and the pulse is therefore compressible.
3. At the beginning of the disease, gout is monoarthritic, usually commencing in some small joint, as the great toe.	3. Rheumatism is polyarthritic.
4. Gout does not leave one joint when it attacks another.	4. Rheumatism usually shifts from joint to joint.
5. An inflamed joint is more sensitive in the transverse diameter than elsewhere. (In the elbow joint, the olecranon process is also very sensitive.)	5. The inflammation and sensitiveness extend uniformly over the affected joint.
6. Veins surrounding inflamed joint are dilated.	6. Veins surrounding inflamed joint are not dilated.
7. Pressure with finger, pits or depresses the swollen part.	7. Pressure with finger does not pit or depress the swollen part.
8. There will frequently be desquamation of the skin after the inflammation has subsided.	8. There is never any desquamation of the skin after inflammation has subsided (of course excluding that due to the application of iodine, etc.).
9. There will be tophi in the joint for the rest of the patient's life.	9. A joint may wholly recover from a rheumatic attack.

The treatment of acute gout is by the administration of colchicum (dose, Tr. Colchici Radicis, gtt. xv. S. To be taken every three hours). As soon as symptoms of nausea appear, or the bowels act as if there was to be a movement, the dose for that particular case has been reached. Some persons who are very susceptible to the influence of the drug cannot bear more than gtt. x.; but usually where the suffering of gout is severe the full dose may be given. In those cases where the bowels are already loose, laudanum may be combined with a x.-gtt. dose of colchicum. Some physicians give this combination after nausea has been produced by the action of colchicum, but the practice is reprehensible; for the heart may be so depressed as to cause cardiac vomiting, and considerable gastro-intestinal enteritis may result. The only other medicine that can control the pain of gout is a nostrum called Laville's Extract. Its formula is well known.

Often this medicine promptly gives relief where colchicum fails. In large doses it acts as a purgative, and its good effects are lost (dose, ʒ i. t. i. d. once in the forenoon, once in the afternoon; or equal parts of Laville's Extract and elixir of cinchona may be given, dose ʒ iss., divided up into three doses for the day).

What has been said of acute gout is also applicable to the *chronic* form. Colchicum or Laville's Extract should be given and the diet carefully attended to. Rigidly exclude all wines containing a considerable quantity of carbonic acid, such as champagne, moselle, etc., and all beers and ales, as these cause gout more than anything else. If the patient insists on having alcohol, spirits such as brandy or whiskey may be given, but not rum, as this also has a tendency to produce gout. As an excess of animal food should not be taken, meat three times a day should not be allowed. Most patients are benefited by blue pill once a week.

For the lithæmic condition, the best remedy is benzoate of soda, gr. x. t. i. d., taken after meals. If there is dyspepsia, a small dose of salol may be added (dose, Salol, gr. ij.; Benzoate of Soda, gr. viij.; made up into two capsules, to be taken one hour after each meal). When there is irritation of the kidneys, the patient should take a small quantity of potash salts—citrate of potash or bitartrate of potash—changed once in a while to phosphate of soda (dose, ʒ i. in course of the day in considerable quantity of drinking water). Colchicum, however, is the remedy to give in all these cases. Whenever symptoms of the disease are aggravated, the patient gets depressed in spirits. He may be put for a week upon treatment by colchicum with its adjuvant, quinine. These drugs always go well together; quinine is a great adjuvant in chronic cases (gr. ¼–⅓ of solid ext. of colch. put up with gr. ij. of quinine, t. i. d. an hour or two after eating). In some chronic cases, it is good to add powdered guaiacum (make up into capsule gr. i. quinine, gr. ¼ of ext. colch., and gr. v. of powdered guaiacum, t. i. d.). No gouty patient ought to lead a sedentary life, as they are always better according to the activity of respiratory processes. Colchicum is also good for chorea with gouty origin. Treat with large doses. As soon as nausea is produced, *chorea* subsides.

Preparations.—

Extractum Colchici Radicis, ...	gr. i.–ij.
Extractum Colchici Radicis fluidum, . .	gtt. ij.–viij.
Vinum Colchici Radicis, ...	gtt. x.–ʒ i.
Extractum Colchici Seminis fluidum, . .	gtt. ij.–viij.
Tinctura Colchici, ...	ʒ ss.–ij.
Vinum Colchici Seminis, ...	ʒ ss.–ij.

CLASS II.—FUNCTIONAL OR SYMPTOM MEDICINES.

Functional or symptom medicines are those medicines which are given for the relief of the symptoms of a disease, or to stimulate or depress some one or more of the bodily functions.

In dealing with medicines of the restorative class, we have seen that the constant repair or nutrition of the body is a slow and not immediately perceptible process, and that consequently the action of medicines which affect nutrition must also be slow and not immediately perceptible. On the other hand, the functions of the various organs of the body are either in incessant activity—*e.g.*, respiration, the function of the lungs; the circulation, the function of the heart and blood-vessels—or else they respond immediately to appropriate stimuli, *e.g.*, secretion, the function of the glands. In precise relation to the rapid and perceptible activity of these functions is the rapid and perceptible action of medicines which affect them. Hence, the features that distinguish these two classes of medicines are based on indisputable physiological facts, and they are so fundamental that a thorough understanding of them is absolutely essential.

Functional medicines should, therefore, produce immediate and perceptible effects, and if they do not it is because the functions of the organ cannot be aroused, or the dose is incorrect. Their whole action is secured by one dose—half a dose of a cathartic, for instance, fails to produce any characteristic effect, and no different effect follows upon repeated doses. Hence they are not cumulative (with the possible exception of digitalis, which occasionally, for some inexplicable reason, is apparently cumulative) and their effect is transient. Thus stramonium may invariably relieve the symptom of spasm in asthma for a lifetime, but the last dose has no more helped to cure the disease than the first one; repeated doses of these medicines only repeating the symptoms of the first dose, without adding any further effect on the disease or on the symptom.

These medicines, which, unlike the restoratives, operate in health as well as in disease, produce no recognizable structural effect upon the various bodily organs, but affect only their functions. Ammonia may stimulate the heart's action, and aconite depress it, so as to accelerate or slow the circulation accordingly, but neither of these agents affects the structure of the heart itself. Opium and tobacco leave no traces on the nerve tissues, though taken for years for their effects on the nerve functions. Even where functional medicines operate with such severity as to cause death, as by the suspension of respiration by hydrocyanic acid, except the actual presence of the drug itself or of some combination into which it has entered, no traces whatever are left by them on the tissues of the body.

As functional or symptom medicines do not operate against any disorders of nutrition, they cannot be expected to cure disease, for disease is a morbid process almost invariably dependent upon disturbed or perverted nutrition of the body. The use of these medicines is to lessen distress by acting against some form of suffering requiring immediate relief, or to deal with some complication, in the course of a disease, requiring immediate attendance. They are very important on this account in the majority of acute diseases, such as inflammations, fevers, etc. These diseases, which may occur in the young and healthy, are of the nature of accidents, for we have no means of modifying them, and expect nature to recover by her own powers of repair. We can, however, by the administration of these medicines, so manage a case of acute disease as to enable the patient to go through it with as little pain and distress as possible, and to relieve any complications which may arise. If uncomplicated, acute diseases are self-limited and terminate, with rare exceptions, within six weeks.

The dose of all symptom medicines is the quantity which will produce the symptoms characteristic of the medicine, and nothing less. Thus, while the ordinary dose of opium for an adult is one grain, it may require in peritonitis twenty grains before a symptom of opium is obtained; if so, the dose is twenty grains.

Functional or symptom medicines are divided into three classes: I. Neurotics; II. Eliminatives; III. Astringents.

DIVISION I.—NEUROTICS. √

Neurotics are medicines which produce their symptoms by affecting one or more of the functions of the nervous system. These functions are so numerous, and differ from each other so widely, that no one neurotic ever acts upon the whole nervous system. For instance, sensation is divided into many different forms; there are the nerves of special senses, of temperature, of muscular sense, and the indefinable sensation of well-being. These different sensations of the body—and the same is true of the motor system, whose manifestations may be either automatic or voluntary—do not resemble each other, and in their disorders they are equally distinct. Hence the use of such terms as "general nervous stimulants" or "general nervous sedatives" is incorrect; for if there was a general nervous stimulant, its administration would affect every nerve and muscle of the body, producing tonic spasm on account of opposing muscles being equally affected. The most widely operative neurotics, such as opium, are yet quite selective, and affect the functions of only a few out of the many nerve centres.

As they are purely functional remedies, neurotics cannot cure real nervous diseases like epilepsy, asthma, etc., as these are generally the most constitutional of all diseases.

The effect of neurotics is usually weakened by repetition, so that the doses have to be increased. Yet they promote the action of organic medicines when they relieve special symptoms of the disease. Thus opium and conium materially increase the efficacy of potassium iodide in syphilitic periostitis when there is much pain, and, on the same principle, chloral, by lessening reflex excitability, assists the bromides in epilepsy.

Owing to the variety of the functions of the nervous system which they affect, it is difficult to make a definite classification of neurotics, but for general purposes they may be divided into:

(*a*) Those which are both stimulants and sedatives, commonly called narcotics.

(*b*) Those which are stimulants only of certain nerve functions.

(*c*) Those which are sedatives only of certain nerve functions.

(*a*) *Narcotics.*

Narcotics, or those neurotics which are both stimulant and sedative, are agents which generally stimulate some nerve functions, while they simultaneously depress others—for example, opium stimulates some of the higher cerebral functions, and also the heart, but at the same time blunts sensation and paralyzes the alimentary canal—or else these agents first stimulate certain nerve functions and afterwards depress the same, but secondarily from exhaustion.

The principal neurotics of this class are :

1. Opium.
2. Alcohol.
3. Ethers.
4. Belladonna and its allies.
5. Cannabis Indica.

I. Opium.

Opium is the inspissated juice of the poppy (Papaver somniferum), which grows in Asia Minor, Western Asia, and India. It is the most ancient of all our great medicines, being well known from a very early period. The opium we receive here comes from Asia Minor, and is the best. The Indian opium is inferior to it. The value of opium depends largely on the climate, soil, etc., of the country where it grows. In Asia Minor, the poppy is cultivated until its capsule grows to about the size of an orange. When the petals have fallen, incisions are made, and from these exudes a juice which upon drying masses together and is then called gum opium. It has all the disadvantages of a vegetable product; it cannot be depended upon for uniformity in strength. One year the gum opium is very strong ; another, the yield is equally good, but the opium is not so strong. We judge its quality by the percentage of alkaloids it contains. A good variety should contain twelve per cent morphine. A great number, however, contain but four per cent.

Opium as a Stimulant.—Opium stimulates the brain in those functions related to thought, more particularly those which have to deal with the imagination. This is powerfully stimulated by opium, and men spend their lives enjoying the pictures presented under stimulation. When this takes place, there is considerable hyperæmia, dilatation of the blood-vessels of the head, throbbing of the arteries, etc. The eye will be brilliant, the pupils contracted, and at the same time the functions of the alimentary canal will be held in abeyance. Prolonged thinking and digestion do not go well together. Hence the frequency of constipation in those who perform much mental work immediately after eating.

As a cardiac stimulant: Opium produces a powerful stimulating effect upon the heart. If a full dose of opium be taken by a strong, healthy man, its action upon the heart may be appreciated by careful examination of the pulse, which is characteristic. The cardiac elements of an opium pulse are: 1st, strength; 2d, slowness; 3d, perfect regularity of rhythm. The arterial elements are: 1st, fulness; 2d, compressibility; 3d, moderate length. Now, this is precisely the pulse of a strong man in perfect health. Its most distinctive features are its equability and its steadiness, both as regards strength of beat and rhythm. It is not affected by those circumstances which ordinarily disturb the heart's action, as change of position, exercise, and mental agitation; this constitutes the important difference between the action of opium and the other cardiac stimulants. Alcohol increases the frequency of the beats, and, for a time, their power also; digitalis increases the force of the cardiac systole, but it interferes with the diastole and causes marked irregularity in the pulse. Opium has not so much a stimulating as a truly strengthening and sustaining effect upon the heart, which is toned up, so to speak, under the influence of the medicine, so as to empty itself forcibly and completely at each stroke.

Opium as a cardiac stimulant is, therefore, indicated in a condition of *shock*.

Shock is a sedative impression *per se,* but differs from other sedative impressions in that it is followed by reaction, which reaction it produces itself. Every one is familiar with the sudden shock produced by a dash of cold water on the face or head. The face turns pale because the arteries contract; the heart jumps because it has to force the blood through the sudden obstruction caused by the contracted arteries. The death of expert swimmers, supposed to be from cramps, is now demonstrated to be due to the sudden stoppage of the heart from its inability to drive the blood through the arteries, contracted from the universal peripheral cold.

Those with strong muscles, but not strong hearts, usually succumb to such impressions, dying instantly. When the heart begins to throb on going into the water, great care should be exercised, and nobody under the circumstances should go beyond his depth. Opium is the remedy for shock, provided collapse is not threatened. Shock is a positive nervous impression, and its effect is always recovered from, when it is recovered from, by increased action; that which was suspended comes back again with redoubled force, so that it is always felt, viz., the reaction, provided the shock is not enough to exhaust the powers. The circulation is increased, the arteries are dilated, and the blood is driven all over the body with greater rapidity and force than before. Hence shock is a positive nervous impression; in itself it is very depressing and always sedative, but when recovered from there is always a reaction, by which is meant that all the vital phenomena first depressed manifest themselves in an increased degree. Hence we repeatedly use shock as a therapeutic measure—cold shower baths, hip baths, etc.—to arouse the system. Occasionally the reaction from shock is injurious, and we are more afraid of it than of the original shock, *e.g.,* surgical shock, when measures are taken against the reaction to counteract the violent inflammation produced by it. Shock may be so severe that it cannot be recovered from and passes into collapse. Shock can induce collapse, but collapse can never produce shock. The terms are not interchangeable, for the reason that collapse is a negative state of exhaustion. Death may take place in this state. If the patient recovers, it will be without reaction.

Collapse, therefore, resembles pure sedative impressions on the nervous functions which are never followed by reaction. Sedative impressions are of two kinds: medicinal, such as the action of hydrocyanic acid and aconite; non-medicinal, such as a warm bath, neither of which is followed by reaction. Shock may be so severe, as in cases of surgical shock, that it passes immediately into collapse without any reaction at all. The vital powers are exhausted, and death results by collapse.

The commonest of all forms of shock are those due to sudden serious traumatic injuries, and, on account of the suddenness and severity combined, are very apt to pass into fatal collapse at once. If this is likely to be the case, opium should never be given, for the reason that in condition of shock the heart is contracted and remains so, and there will be a corresponding contraction of all the arteries. So long, however, as the arteries are contracted the patient will not die with symptoms of collapse. Collapse is characterized by relaxation of the heart, all the symptoms indicating that the heart has no power to propel the blood through the body. The portal system becomes congested; there will be difficulty of breathing, owing to the pulmonary congestion present; also suppression of the urine, due to the same cause in the kidneys. The surface of the body looks shrunken and shrivelled, so that a familiar face may be totally unrecognizable. After death, the heart will be in a state of dilatation, and all the organs will be swollen with an accumulation of blood. Now, opium causes the heart to fully dilate before its stimulant effect can be felt upon the systole, and this very state of things is produced. No medicine should be given in this condition which relaxes the heart as opium does. In a case of surgical shock where there is danger of the patient passing into a state of collapse, medicines must be given that increase the systole of the heart, such as alcohol, brandy, and ammonia. If there is time, *i.e.*, no immediate danger of collapse, in surgical shock, then opium is the medicine of medicines; so that in many cases it is good practice to give opium with brandy, alcohol, etc., where there is no fear that the patient is going to sink too suddenly. Medical shock is produced by all injuries to the abdomen and the abdominal viscera, and produces the same effects as surgical shock. Thoracic inflammations do not tend to produce shock, but the reverse, there being great exaltation of spirits, etc., as in phthisis. But disturbing the abdominal viscera, even functionally, results in depression; the smallest surgical injury to the abdominal cavity will produce shock. Hence in all affections of this kind there is a small, flickering, incompressible pulse, and generally a weak one, all the way through from first to last. This is just the opposite of the opium pulse; hence it is that opium is the remedy for *peritonitis*, as only such functional remedies can be. Some have supposed that the object of giving opium in peritonitis is to confine the bowels; but obstinate constipation is a prominent symptom of this disease, because the muscular coats of the intestines are completely paralyzed for the time being, and opium would be superfluous if there were no other indication for it.

Neither is opium given merely to relieve the pain, for cases of painless peritonitis do occasionally occur which require as much opium as any others. Besides, this hypothesis will not account for the remarkable tolerance of opium which forms so characteristic a feature of peritonitis; for in *pleurisy*, which is also an inflammation of a serous membrane, and may be just as painful, ordinary doses are all that can be borne, and are quite adequate to relieve the suffering.

What does opium do in peritonitis? It does not act as a sedative, nor to keep the bowels quiet—the disease itself does that. Neither is it given to relieve pain. It therefore acts as a cardiac stimulant, to prevent the great danger in abdominal injuries, viz., cardiac failure and consequent death.

Lastly, opium is of use as a stimulant where, without the least pain on the part of the patient, he nevertheless is going to die quickly from poisoning by *gangrene*. This poison, when taken into the system, is a powerful anodyne. It suspends pain and distress almost as well as opium itself does. The patient is generally in fair spirits and dies quietly and peacefully. In this disease there is deathly pallor, the patient begins to grow cold, has a disagreeable perspiration, and, after a little time, faints away and dies. This disease tolerates opium, showing that it is being used up as a stimulant; hence in this condition large doses should be given. There is a *skin disease*, lately described by Mr. Hutchinson, beginning as a blister, in which patients all died from gangrene until treated with opium, when they began to recover and in some instances were cured.

The stimulant properties of opium manifest themselves in a particular form of stimulation of the intellectual functions, also of the heart, and, to speak rather vaguely, though about as near as we can express it, of the general vitality of the system. Great prostration occurs in the course of gangrene and sloughing inflammation. When sloughing phagedæna attacks a soft chancre, the patient should be brought as quickly as possible under the influence of opium; also in similar conditions not specially connected with gangrene. Opium checks the inflammatory processes, and turns them into adhesive rather than necrotic forms of inflammation. There is one element in the intellectual stimulus which is of peculiar importance and very difficult to describe. It comes as near as possible to the condition of mind to which we apply the term *interest*. A person interested in a piece of work can do a far greater amount of actual labor and feel less fatigued than one who does not have this interest. A sportsman will walk double the number of miles in his pursuit of game that he could under ordinary circumstances; somehow the muscles do not tire so rapidly. We know as a fact that the brain has a great power over this vital force, often preventing the system from giving way under conditions of great physical strain; and this endurance will be proportionate to the development of the brain, as is shown by the fact that officers bear fatigue better than common soldiers. The mind can supply to the physical frame something of the nature of a stimulus antagonistic to waste, and this condition is remarkably present in the action of opium. A person taking a stimulant dose of opium finds himself in a state of great mental interest. He does not want to do anything but contemplate the mental pictures that in his imagination rapidly pass before him, and which he notices with a sense of delicious quiet and superiority to all the annoyances of life. He is not excited; on the contrary, calm and philosophical. This condition is one of the most seductive and irresistible to overcome of all desires that can be awakened by any physical substance in our constitutions. There are certain articles which when taken into the blood produce corresponding mental and emotional conditions and changes, so much so as for a while to make new beings of us—not better beings, but new ones. Alcohol, for instance, transforms the secretive person into a communicative one, the dignified into one who shows a contemptible familiarity with all, the peaceable man into a pugnacious one, etc.

There is a marked difference, however, in the action of narcotics. Opium is just as difficult to resist as alcohol, even more so, but the man who has taken opium prefers to be solitary; he is company enough for himself; he does not want his visions broken in upon. On the other hand, the alcoholic drinker is necessarily gregarious; he does not want to be alone, because the stimulation is not of the imagination but of the feelings. But certain disasters occur to those addicted to any one of these physical means of altering their ordinary constitutional temperament. Opium is more pronounced in its results and more ruinous than alcohol. The mind is not injured by opium; very few cases of opium-eating lead to insanity. But instead of that the will power, that which makes us really what we are, is ruined. Our mental and intellectual processes are mechanical; our ideas come and go from us without any other than mechanical origin. There is no doubt whatever that our intellects are just as much machines as our hands and feet. Our ideas are dependent upon previous impressions made upon us, and we are not responsible for them. But man possesses something else besides mind; he is something more than an intellectual machine. He possesses a high capacity, called the will, which holds him responsible for the way in which he allows his mind to work. He is not responsible for thoughts which come unbidden to his mind, but he is responsible if he entertains them. He has the power to drive away thoughts which he does not wish to remain with him, and *vice versa*. This habit can be cultivated by having a governing principle or purpose controlling life, and it is this power of the will which mainly differentiates man from the lower creatures. Unfortunately opium, alcohol, cocaine, chloral, chloroform, and cannabis indica have the power, not of altering the mind (even if they do derange the mind, it is quickly recovered from), but of producing a far more serious and ruinous derangement of the power of the will over the mind. The mind is as good as ever, and so is the will, but the connection between them is broken. Nothing can be more pathetic than the confessions of powerlessness of those who have become addicted to these drugs, to free themselves, as De Quincey called it, from the accursed chains which bind them. Effort after effort may be made, but fails, until finally the struggle is given up in hopeless despair, and the man lapses into a mere intellectual machine, dreaming away his whole existence, a visionary, helpless human being. In the use of alcohol, on account of its having to do more with the feeling, etc., than with purely intellectual operations, the degradation is most evident in the moral sentiments. The drinker laments his failing at first and is deeply ashamed, having lost his true self; some suffer from this so acutely as to commit suicide. After a time this feeling passes away, until all sense of shame is ultimately gone—the worst of all results of this criminal tampering with our frame by addition of that which ruins the dominance of the will.

Sedative Actions of Opium.

There are different sensations and modifications of sensation—the sense of temperature, tactile sensation, pressure, localization, pain, etc., each independent of the other. This is so with the anodynes. These agents, which allay the sensation of pain, are not all alike. Some will allay certain forms more than others. Opium is no exception to this rule.

As an Anodyne.—The pain characteristic of inflammation local rather than radiating, excited or increased by movement or pressure on the part, is relieved more by opium than by any one medicine acting directly to relieve that pain without blunting the whole nervous system, as when ether or chloroform is given. Hence the great use of this medicine in diseases with *acute inflammatory pains.* When these pains are in the periosteum, they give rise to a sense of intolerable aching. This is one of the characteristics of inflammations, occurring very early in meningitis. When the pains are in fibrous tissue and serous membranes, they are of a stabbing or boring character, or both. In the pain of mucous membranes, there will be a sense of soreness. In all of these opium gives decided relief. The dose for simple inflammatory pain for an adult is about one grain of good opium; but when the patient bears larger doses before the pain is relieved, there are very likely other elements than mere inflammation causing the pain—that is, if the patient has not been accustomed to the use of the drug.

As an Antineuralgic.—Neuralgic pains differ from inflammatory pains in that the part to which the pain is referred is not aggravated by movement or pressure, and is apt to radiate, following the course of the affected nerve. Neuralgic pains are of different origin. Some are due to pressure on a nerve, as in cases of tumors, cancers, abscesses, etc., which, besides pressing upon it, may involve the nerve in its growth or stretch the nerve by its growth. Others are due to the dilatation of a very narrow duct, owing to the presence of a calculus, renal or hepatic. These have a special tendency to produce faintness, nausea, or vomiting. Lastly, there are pure neuralgic pains very difficult to account for. In many cases, they accompany a state of anæmia; in other cases, they accompany a state of poisoning, those of malaria being characteristic. In all these different non-inflammatory pains, opium may be used; the effect will not be at all proportionate to the dose, as in inflammatory pains, but it should be used continuously for a long time. When patients get accustomed to it, the dose must be increased, until often quite a large amount has to be given. On this account, opium should be assisted by other anodynes, on the principle that a combination of two or more neurotics, in small doses of each, is more powerful than a corresponding large dose of any one of them. All neurotics can be made to work together, even when they oppose each other, paradoxical as it may seem, but no antagonism of neurotics is of a chemical kind. No neurotic is the antidote of another in the same way that an acid is the antidote of an alkali. Instead of that, the antagonism is an illustration of the law that while some of them stimulate certain functions, others simultaneously depress them. There are also neurotics which, while antagonizing each other on one function, reinforce each other on another function—*e.g.*, atropine and morphine. Atropine stimulates the respiratory centre; the breathing becomes more rapid and stronger. Opium has the opposite effect upon the respiratory centre, diminishing the frequency of the respirations; not only this, but partially suspending them, so that there is a marked interference with the breathing. Opium destroys life very soon by paralyzing respiration. Atropine can be used for counteracting this depressing effect. Belladonna and atropine are then really antidotes to opium. Opium can also be used as an antidote to belladonna poisoning in the first stage. On the other hand, opium is a sedative to the sensory system of nerves, and so is atropine. Hence in many cases a better anodyne effect is secured by combining the two; here the atropine does not antagonize the action of opium, but on the contrary assists it. *Hence no class of medicines ought to be more often combined than neurotics*, as thereby the injurious effect of large doses of any single one of them is avoided. In the case of severe inflammatory pain, nothing equals opium, and in these cases it answers very well alone. For neuralgic pains, however, opium should not be given alone, lest by doing so the foundation is laid for the development of the opium habit.

As an Antispasmodic.—Opium will relieve spasms of a certain kind only, namely, those due to distention of ducts by calculi, etc.—the bile duct, the ureters, etc.—notably in cases of gall stones and renal calculi. Very intense spasms occur in the passage of a stone, which not infrequently arrest its progress, and opium is an admirable antispasmodic for this purpose. The patient should be brought rapidly under its influence by hypodermatic injections of morphine, and very often the spasm will subside, the tube relax, and the stone pass through.

As a Soporific.—Opium is a soporific, having a tendency to produce sleep, which may not be immediate, however, owing to personal idiosyncrasies. With a large number of persons, it has no tendency to produce sleep, so before prescribing it for this purpose it is well to ask patients if they have taken it before for the same purpose. Some are kept wide awake all night by visions, etc. In other cases, especially in women, it sometimes produces a distressing sensation and a good deal of nausea as well. Usually it is where persons have been kept awake by pain that opium acts best as a soporific, as well as relieving the pain. Large doses will produce somnolence, except in special cases. The sleep produced is heavy, with slow respiration. This means deficient oxygenation of the blood and the accumulation of carbonic acid gas, on account of the slow expiration, the patient waking up unrefreshed and with pain in his head. That this is due to CO_2 poisoning is rendered probable by the fact that when opium is given in the daytime, when the patient can respire in the open air, etc., it does not produce headache. This only occurs after sleep, and is sometimes very severe and lasts for a long time, accompanied with a greater or less amount of nausea. A remedy that prevents nausea pretty well is hydrocyanic acid.

After great muscular soreness, as after parturition, a dose of hydrocyanic acid, morphine, and chloral is very good.

Another sedative action of opium, and a very important one, is its power to *paralyze the peristaltic movements of the intestines*, producing a perfectly motionless condition, particularly of the upper part. Hence it is of considerable use in allaying excessive peristaltic movements occasioned by the presence of inflammatory products. Irritation of the bowels results in one of two things—first, intense pain and obstinate constipation with vomiting, which means enteritis, an inflammation involving the entire mucous membrane of the inflamed part, and spreading to the other coats, being very likely to end in peritonitis, the pain at first being localized. In this case, opium should be given, but with considerable discrimination as to whether it should be the first thing or not. When it is given, it is for the purpose of allaying pain, having more power in this tract for this purpose than in any other part of the body to allay inflammatory irritation.

Another and more common form is inflammation leading to mucous catarrh. An abundant flow of serum takes place, and, if sufficiently diluted, there is nothing but a watery diarrhœa. Very frequently this flow simply mixes with the intestinal contents, producing irritation, then fermentation and excessive irritation. When this happens, the peristaltic action begins to be very much increased, and amounts finally to irritation of the middle or muscular coats, which produces cramps, and this hurries on the offending matter until discharged from the bowels in the form of an acrid, burning, irritating discharge, indicating that such matter could not remain longer in the bowels without causing pain.

There is this difference between pain dependent upon irritation of the mucous membrane and localized enteritis, viz., in the former the sense of diffused soreness continues between the cramps, and there is a feeling that it is in the stomach at large. Opium should be given here for the purpose of allaying irritation and peristaltic movements, and by so doing check the movements of the bowels.

Another condition of the bowels is that state resulting from this irritation, viz., that for some time there remains a weak irritability in which there is a great deal of peristaltic movement without pain. Here we have an indication of the same kind of weak, nervous irritability that belongs to all mucous membranes when they have been the seat of acute inflammation. Here opium does good, because it allays the unnecessary irritability, which at first serves a good purpose by helping the offending matter to be voided; afterwards, however, and especially in children, it keeps up the diarrhœa from the remaining irritability after inflammation has subsided. In the first form—enteritis—if called to a recent case, and you find the patient has attacks dependent on some very indigestible material in the stomach, and not due to intussusception, organic stricture, or hernia, opium should *not* be given. Give castor-oil, and, after that has acted, then give opium. If, on the other hand, some considerable time has elapsed and symptoms are severe, then opium should be given at once, for this very often, when the enteritis has lasted for twenty-four hours, relieves the constipation. How does it do this, since opium itself produces constipation? By suspending the spasmodic stricture of the intestine at the seat of inflammation, by causing the pain there to subside; and after the stricture subsides, the bowels move of their own accord.

Diarrhœa is divided into two kinds :

1. The diarrhœa due to inflammation of the intestines as the result of fermentation in them.

2. Diarrhœa due to the absorption of ptomaïnes into the blood. This form is totally different from the first, and is the choleraic diarrhœa. Its genesis is entirely different from the first, and hence should be treated differently.

The diarrhœa caused by fermentation is brought about by the alteration or suspension of the natural secretions, which fulfil the double function of being digestive and antiseptic, the latter being quite as important as the former. Many diseases are now distinctly traceable to this suspension of antiseptic secretions. One-half the cases of Bright's disease in this country primarily take their origin in the intestines. It is now known that one of the great functions of the intestinal secretions is to prevent materials from being decomposed by fermentation, so that they can be properly digested; and hence whenever the secretions are absent, not only is the digestion imperfect, but fermentation occurs, which varies very much in its results in different parts of the intestines. Under certain circumstances there will be fermentation of starchy materials, producing enteritis and diarrhœa, until the starchy elements have been gotten rid of. Many cases of chronic diarrhœa are successfully treated by discovering what article of diet is particularly difficult for the patient to digest, which opium would have failed to cure. Worse than fermentation of saccharine matters is fermentation of the oily elements of the food, which produces an extremely irritating series of acid products. This begins in the stomach itself, and is continued to the upper part of the intestines. Patients frequently vomit very acrid materials so irritating that it burns the œsophagus, the throat, and the mouth, produces tears, and causes the nose to run. It is not uncommon for patients to feel as if they had sore throat, owing to the intense irritation produced by these acrid products. Enteritis will inevitably result. But the worst of all is the fermentation of the nitrogenous principles of the food; this produces horribly fœtid stools, with a special tendency to produce irritation of the lower part of the intestines, viz.; dysentery. There is a putrid odor in addition to the sour odor, and the dysentery is an effort of nature to expel the offending material.

The treatment here is to wash the intestines clear of such offending material. The discharges will frequently be mixed with mucus and pus. No mucous membrane, paradoxical as it may seem, should discharge mucus, at least not in any great quantity. The very first thing to be done is to get rid of the mucus discharged by the irritated or ulcerated mucous membrane, and the whole trouble will subside very often as promptly as in the case of inflammation of the bladder, where pus may be in the urine for months. If the bladder is washed clean twice a day, leaving a little material in the bladder to keep the two surfaces from rubbing together, rapid improvement takes place at once. The principle of this treatment is the same that should govern the treatment of chronic dysentery, viz., to wash the inflamed parts quite clear; this acts better than any medicine. Chronic dysentery is one of the most obstinate diseases, lasting sometimes from ten to twenty years. The reason is that some mucus is left decomposing over the inflamed surface, which ulcerates, and when this happens the case is extremely difficult, because the ulcer is every few hours torn open by the action of the bowels, and the ulcerated surface smeared over with fæcal matter. The treatment consists of large injections of peppermint water, and this is often quite sufficient to cure this complaint without any medicine.

The number of cases of fatal dysentery and diarrhœa would be much lessened if they were not treated with opium, because the stoppage of the bowels produces fermentation in addition to that already going on. The treatment should be to let all the fermentative matter out, because it is irritating the mucous membranes down to their deepest parts, and the trouble should be corrected at its origin by restoring the natural secretions. Usually the liver is out of order; the patient is sallow and perhaps has been eating indigestible food. The indications are to clean out the bowels, then give a good agent for restoring the natural secretions, and follow this up promptly with antiseptics for the intestines. Do not give opium unless the patient has many movements, due to irritability remaining after the former movements, when a small dose of opium can be given to allay the pain and too frequent movements, but not by any means to lock up the secretions. Disinfect the intestines, and the diarrhœa will in a great majority of cases stop of its own accord. This treatment is to be persisted in from the beginning to the end. Opium is the adjuvant, but disinfectants are the special medicines against every form of intestinal catarrh, whether it be diarrhœa or dysentery. This is the principle upon which opium is to be used in intestinal disturbances.

Choleraic diarrhœa is quite different from that just described. It is different in its symptoms. First, instead of pain preceding the movements, with griping action of the intestines, it sets in with a painless, watery discharge, with often little odor. The patient does not mind the first movements, being, if anything, relieved by them. In the fermentative form of diarrhœa, the pain is for a time relieved by movements, and then comes on again. Not so in choleraic diarrhœa. The first movement is quite painless, the second also; but with the third the patient weakens, the face turns pale, the pulse is rapid, fails in size and strength, and he begins to show the very perilous symptoms of collapse; vomiting sets in with purging, and the patient sinks more and more. These symptoms are present in cholera morbus, and are typical of Asiatic cholera; they are also present in the choleraic diarrhœa of infants. In regard to the latter, it is very unfavorable if the child does not cry with the movements. It would be a better sign if griping pains were present. Choleraic diarrhœa is produced by a poison generated in the intestines by bacteria which differ in different countries, but are evidently of the same general species. Bacteria infect children more than adults. When they appear in adults, it is called cholera morbus. In India, they are the source of epidemics of Asiatic cholera, producing a poison which, being absorbed into the system, paralyzes the solar plexus, producing effects similar to that produced by extirpation of the solar plexus in animals, viz., profuse serous discharge, with shedding of the epithelium of the intestines in flakes, causing rice-water discharges, and in infants cerebral symptoms, they generally dying in convulsions, and on post-mortem examination there will be found an effusion into the ventricles of the brain. In these cases never give opium; if it is of any use at all, it is to sustain the heart as a stimulant. When there is pain, as in some forms of cholera morbus, do not rely upon opium so much as upon camphor, which is the counteracting, antiseptic, and sustaining agent. It kills the bacteria, prevents the poisoning, and besides this it raises the power of the heart.

In *chronic disease of the intestines*, use opium steadily, for the reason that no chronic trouble of the intestines occurs without producing a weak, irritable condition of the bowels, leading to increased peristaltic action. Small doses should be given, the object being simply to prevent peristaltic irritability. One-quarter of a grain of opium can be given as an adjuvant, along with other remedies, three or four times a day in choleraic diarrhœa or dysentery; but do not rely upon opium.

The difference between diarrhœa and dysentery is marked, though sometimes the symptoms are mixed, there being diarrhœa and dysentery together; but whichever disease predominates, the symptoms will be according to it. Dysentery always keeps the pylorus open, so that very little can be kept in the stomach; and on this account it is liable to produce starvation, as may be seen in little children with this disease, who look almost like skeletons. Dysentery is very apt to come on immediately after eating, so that the odor of the food taken into the stomach can be detected in the fæces; and it is also effected by moving about. It is allayed by lying down, and therefore does not occur as often at night as during the day. Besides this, there is a sense of tenesmus after an action of the bowels; so that instead of being relieved by the movement, the patient feels worse, as if he must have another movement. This symptom is a plain indication of dysentery. In addition to this, there is a discharge of blood which is bright, not dark, indicating that it has come from the lower, not the upper, part of the intestines.

All. of these symptoms contrast strongly with those of diarrhœa. Diarrhœa most commonly occurs early in the morning before the patient's usual time for getting out of bed, commencing when he is lying down; during the day there are but one or two movements. If it is chronic diarrhœa, there are generally pretty profuse movements in the morning. Eating does not especially start the diarrhœa, nor does walking. The odor of the food cannot be detected in the fæces, as the contents of the stomach have been there for a number of hours, and so have been changed. It is of great importance to find out at what time the movements occur. If early in the morning, it is diarrhœa; if during the day, after walking, it is dysentery.

There is one kind of dysentery, however, that is different, viz., malarial dysentery, dependent upon an infection of the system by malarial poison—a disease that carries off multitudes of Europeans visiting the tropics, and is also common in New York City. The symptoms differ on account of this fact, viz., that they are constitutional. It is usually ushered in with a chill, followed by high fever and intense headache, aching in all the bones of the body, and this is followed by profuse discharges from the bowels, uniformly mixed with blood. A case beginning in this way is one of constitutional infection, of which dysentery is one, but only one, of the elements. Large doses of quinine should be given immediately, before the dysentery is dealt with at all. In neither of these cases should opium be given at the beginning.

√ OPIUM POISONING.

This is the commonest form of accidental or intentional poisoning that physicians are called upon to deal with. Its symptoms are very pronounced, and afford a test for distinguishing the unconsciousness of opium poisoning from that due to other causes. And this brings up the different kinds of *coma*. Coma is not infrequently defined as a state of insensibility. This is not as clear as it should be, as such a definition would include sleep, the syncope of a fainting fit, etc. Coma may be defined as a state of insensibility with symptoms of brain pressure. No form of real coma can exist unless some portion of the cerebrum is compressed either directly or indirectly, *e.g.*, the venous exudation of serum into the ventricles from a blow on the head. The same part or the same nerve centre will not be affected in all comas, but nevertheless some part, if not the whole, of the contents of the cranium will be in an unnatural state, owing to the altered circulation of the blood.

Syncope is a condition of simple failure of the arterial circulation of the brain. It may be due to sudden stoppage of the propulsion of blood from the heart, leading to immediate insensibility. This condition may be distinguished by the character of the pulse and the state of the heart itself; it is a condition of profound anæmia. It differs from collapse insomuch that in syncope the consciousness is lost, in collapse it is retained. The circulation is very much affected in coma, but not in the same way as in syncope; therefore syncope cannot answer at all to a condition of coma.

Opium Coma.—In the first stage, the face is swollen, due to a stasis of the venous blood of the face, and this gives, along with the heavy, swollen aspect, a dark flush. Along with this there will be a *symmetrical* contraction of the pupils of the eyes, so much so as to be likened to a pin's head in many instances; this condition of the pupils should at once lead to a strong suspicion of opium poisoning. Next the state of the skin should be noticed. In opium poisoning, as opium is a powerful diaphoretic, the skin will be wet with perspiration, and, owing to opium being also a cardiac stimulant, it will not be a cold, clammy sweat in the majority of instances, but similar to that produced by exercise. The respirations should be carefully noticed; they are characteristically affected by opium. They are slowed, sometimes falling even to five per minute. Another characteristic of the respirations is that they are very deep and stertorous, as if the whole lung was being inflated, and a marked pause intervenes before expiration. In the first stage, the pulse will be slow, strong, regular, large, and quite compressible, and therefore short. Having noticed these things, which, if taken together, are quite pathognomonic, endeavor to arouse the patient. In a great majority of cases, this can be done, the patient coming back to consciousness for a brief period. At once put some question and notice the answer. The articulation is good, what he says he pronounces distinctly, and the answer is rational, although, from returning unconsciousness, he may not be able to complete it; all of these symptoms together leave very little doubt of opium poisoning.

Alcoholic Coma.—This is the commonest form of coma. The face is flushed, but it is an arterial flush; the pupils are not contracted; the skin may be covered with perspiration as in opium poisoning. There is a marked difference in the respirations in the two cases. In alcoholic coma, instead of being slow and deep, they are regular and hurried, and there is quick expiration following inspiration. The pulse is very different, and by this it can be determined whether this coma is combined with the preceding one, viz., whether the coma is due to both opium and alcohol. The pulse should always be quick and strong, unless the patient has been in alcoholic coma for some time, when it will be quick but weak. If any attempt is made to arouse the patient, he returns to a drunken consciousness. His answers are not rational, and the words are not well articulated, the first effect of drunkenness being to produce thickness in utterance; not only that, but he is irritated by interference and probably uses profane language. Individuals under the influence of opium never swear.

Uræmic Coma.—This is very characteristic in one particular: the pupils are insusceptible to light; they may be contracted, but not symmetrically so, or one may be contracted and the other dilated, or, as is not uncommon, both may be dilated. The respirations are very irregular, sometimes rapid, sometimes slow, but, as a rule, there is not the deep inspiration of opium poisoning, though occasionally there is stertorous breathing. The pulse is very changeable, sometimes being quite rapid, in other cases slow, and has a tendency to irregularity and incompressibility in the majority of cases. If, in addition to the incompressible pulse, rigid arteries are present, it is highly presumptive that the coma is uræmic in character. As a rule the face is pale, but, if not, the hands will be very white. In uræmic poisoning, the skin is of a dead white, chalky color.

Apoplectic Coma.—This sometimes resembles closely the coma of opium poisoning. The respirations may be very slow; usually, however, they are very irregular, sometimes slow, sometimes rapid. The pulse may be very hard or very full, as in opium poisoning. The hands should be noticed. In many cases, one hand is moving, the other lying motionless at the side of the body. On taking up the hand, it will be found that the arm behaves in a like manner; in other words, there is more or less paralysis of one or more of the extremities. On examining the eye, not infrequently there will be found strabismus. If this is the case (when strabismus did not exist before), the diagnosis is settled. The pupils may be either contracted or dilated, very commonly the latter.

Finally, there is coma due to concussion of the brain from blows on the head, etc. (It is very important to distinguish this form, as it is often due to criminal assault.) There is something very characteristic in this form of coma, viz., the control of the brain over the spinal cord is withdrawn, and consequently the reflexes of the spinal cord are set free, and hence every external impression leads to twitching of the muscles, sometimes sufficient to produce a movement of the whole limb. Hence, wherever there is jactitation it points to some injury of this kind to the head, and is very characteristic.

Lastly, in the coma of apoplexy and concussion of the brain the patient cannot be aroused. In the coma of alcohol and opium, he can be. In uræmic coma, except in a few cases, the patient cannot be aroused. If he does come to consciousness, he does so spontaneously, and not because of any efforts made to bring him to.

The second stage of opium poisoning is quite opposite to the first. It occurs during the condition of collapse that shortly precedes death, and as a rule nothing can be done for it except to greatly stimulate with alcohol or, better still, nitroglycerin. This stage has all the symptoms of profound exhaustion of the respiratory centre and of the heart. Instead of a turgid and livid countenance, it is pale; instead of contracted pupils, they may be widely dilated; and there will be rapid and shallow breathing, extremely feeble and perhaps rapid and very compressible pulse. The patient cannot be aroused; but if any answer can be elicited, proceed at once to the treatment of the second stage.

Treatment of Opium Poisoning.—The measures applicable to the first stage are not at all applicable to the second stage. In the first stage, the stomach should be thoroughly washed out, either by means of the stomach pump or by the stomach tube; this is very important, and many lives can be saved by so doing. If it is certain that opium has been taken in the liquid form, as laudanum or the solution of morphine, or that the opium has been in the stomach for some time, the patient having been in coma for a number of hours, it is useless to wash out the stomach; it is only wasting time. Recourse must now be had to the two great antidotes. The first by all odds is the tincture of belladonna. It should be given in xx.-gtt. doses, repeated every twenty minutes, watching carefully meanwhile the respirations of the patient. As soon as they are increased to about sixteen, cease the administration until the respirations begin to fall again. Also watch the pupils of the eyes; as soon as they dilate, even if the respirations have not increased, the dose should be given less often. Belladonna has been given in these cases in doses that would have been poisonous if opium had not been taken, but the opium counteracts the belladonna, and conversely. Twenty minutes between the doses is long enough to wait, if the symptoms of opium poisoning have not disappeared. Along with belladonna, and in no way interfering with its action, is caffeine, preferably in the form of strong coffee. This may be administered at the same time that belladonna is given, and all possible means should be used to arouse the patient; he should be prevented from lying down, as this has a tendency to diminish the respirations; keep him moving about, and do not give alcoholic stimulants, as they are injurious in this stage. Finally, electricity should be used; this is of greater value in the second stage, but can be given in both, the object being to stimulate the diaphragm, which, with the heart, has a tendency to stop. Place one of the poles of a faradic battery at the nape of the neck, waiting until the patient has had expiration. As soon as through, apply the other pole to the epigastrium, pressing upwards to bring it forward upon the chest. The action of electricity can sometimes be increased by dashing cold water suddenly upon the chest (not upon the face), as stimulation of the surface nerves of the chest causes inspiration.

Do not apply electricity to the nostrils, as this stops inspiration. Also place the poles suddenly on different parts of the chest and over the region of the heart; a continuous application in one place is injurious.

Occasionally the patient should be laid down flat and artificial respiration resorted to. In this case, keep the battery to the nape of the neck when the face is turned downwards, and when the patient is turned on his back apply again to the epigastrium, and so on. In the second stage, or stage of collapse, do not use any of the remedies above mentioned except electricity. The condition is now one of great exhaustion. As it is impossible to keep him walking in this stage, he should be laid down. Use cardiac stimulants; brandy and water should be given *ad libitum*, there being no necessity to take into account the effect of large doses of alcohol, because cardiac failure is imminent owing to the excessive weakness.

The following prescription should be used :

℞ Tincturæ Nucis Vomicæ, ...	ʒ i.
Tincturæ Strophanthi, ...	ʒ ss.
Caffeinæ Citratis, ...	gr. xxx.
Spiritus Ammonii aromatici, ...	℥ iss.
Aquæ, ... q. s. ad	℥ iij.

M.

Dose, two teaspoonfuls every half or every hour, to be given in ℥ i. of brandy.

Hypodermatic injections of nitroglycerin should also be given at the same time, gr. $\frac{1}{100}$ at each dose. Meat juice extracted from beef steak should be given every fifteen minutes; it can also be given freely by the rectum, as it is a strong stimulant. The only hope is to tide the patient over this deathly collapse. Dry heat can also be applied to the feet and epigastrium.

Preparations.—Gum opium contains two alkaloids that are of sufficient importance to mention specially, viz., morphine and codeine. It contains other alkaloids and principles of the glucoside class, so that opium has therapeutic properties not possessed by morphine. In the first place, opium is more of a cardiac stimulant than morphine. For a case, therefore, of peritonitis, opium is preferable to morphine. The following rule is a good one : Where there is a small, irregular, hard pulse (as in something of the nature of peritonitis, abdominal inflammations, gangrene, or in certain skin diseases that end in death by producing gangrene), opium as a stimulant should be used rather than morphine, which has slight stimulating properties only. Morphine, however, has all the other actions of opium, viz., anodyne, diuretic, diaphoretic, etc. Very often mistakes are made in regard to the administration of this powerful poison. Little children should not have opium given them, unless with extreme care. Infants scarcely bear opium at all. Death has resulted by the administration of one drop of laudanum to a child six months old. One drop of laudanum to a child one year of age is a large dose, for the reason that the disproportionate development of the brain to the rest of the body in children renders them peculiarly susceptible to the influence of this drug.

Alkaloids: Morphinæ Sulphas (dose, gr. ⅛).
Codeina (dose, gr. ss.–i.).

Liquid Preparations of Morphine:

Liquor Morphinæ Sulphatis (U. S.) [Morphinæ, gr. i.; Aquæ, ℥ i.] (dose, a teaspoonful).

Liquor Morphinæ Sulphatis, Magendii [Morphinæ, gr. xvi.; Aquæ, ℥ i.] (dose, ♏ v., equal to one-sixth grain of morphine).

Neither of these two solutions of morphine is officinal.

Preparations of the Crude Drug:

Pulvis Opii (dose, gr. i.–ij.). Pulvis Ipecacuanhæ et Opii, or Dover's powder, or the compound powder of Ipecac. Ten grains contain Opium, gr. i.; Ipecac, gr. i.; Sugar of Milk, gr. viij.

Liquid Preparations of the Crude Drug:

Tinctura Opii, or Laudanum [Opii, gr. xlviij.; Alcohol, ℥ i.]. Ten minims are equal to one grain of opium; there are two drops to one minim, consequently twenty drops are equal to one grain of opium.

Tinctura Opii Camphorata, or Paregoric (gr. ij.–℥ i.). In addition to the alcohol, it contains camphor, benzoic acid, oil of anise, and glycerin. This preparation is very pleasant to the taste, and has the advantage of acting upon the bronchial mucous membrane in bronchitis with soreness. It is well adapted for children. Ten drops should be the outside dose for an infant.

Opium can be combined with a number of different medicines, so as to have actions that opium by itself cannot produce. It can be made to act admirably as a diuretic or to promote the action of diuretics, notably when the kidneys are irritated or inflamed, *e.g.*, as in stone or gravel. In these cases, the camphorated tincture should be given with buchu. This will also act well in cases of irritability of the urethra and bladder, increasing the good effects of buchu and allaying pain and soreness. Opium by itself is a diaphoretic. This diaphoretic action is strikingly shown by combining it with ipecac to form Dover's powder. It is an excellent diaphoretic in many conditions of dry skin with considerable pain, *e.g.*, as in inflammations with fever. Dover's powder acts very well here, also in conditions where there is a hard pulse, dry skin, and restlessness; and if the tincture of aconite root be added in doses of from four to five drops, the diaphoretic action is promoted, and there is less cardiac disturbance than when the Dover's powder is given alone. Another very good combination in some cases is the extract of colchicum, Dover's powder, and aconite. This combination is very good for articular pains.

Magendie's solution is principally used for hypodermatic injections, and five drops are equal to one-sixth of a grain of morphine. This should be remembered, as many deaths result from the careless use of the hypodermatic syringe, frequently fifteen minims being given. With a patient unaccustomed to morphine, begin with five drops, and increase as necessity demands.

SUMMARY OF THE USES OF OPIUM.

1. As a stimulant, opium acts as a stimulant to the brain, the heart, the intellectual functions, and general vitality of the system.
2. As a sedative, opium acts as an anodyne to relieve pain.
3. It also acts upon the intestines to arrest excessive peristaltic action, and for certain forms of diarrhœa.
4. As a soporific.
5. As a diuretic, especially the camphorated tincture combined with buchu.
6. As a diaphoretic.

II. Alcohol.

As a medicine, alcohol is a sedative as well as a stimulant, and quite as much one as the other. Alcohol, as such, is the most complex of all medicines, in the sense of having so many preparations.

As a Cardiac Stimulant.—Its action upon the heart is similar to that produced by violent muscular exercise. The pulse is rapid, strong, regular, full, compressible, and very short; consequently the arterial system is dilated, respirations are increased, and the heart beats with a force and steadiness of rhythm resembling that produced by opium, but differing in frequency. This is the main medicinal action of alcohol; but as, when violent muscular exercise is prolonged, exhaustion results, so this rapid action of the heart, produced by constant doses of alcohol, finally ends in cardiac weakness. Alcohol requires a great deal of discrimination in its administration. The following rules should be closely followed: As a cardiac stimulant, it should be given where heart failure is impending and there is danger of the patient dying from this. The radial pulse is not always a good indication of the strength of the heart. An incompressible pulse, due to obstruction of contracted arteries, may give the impression of a full, strong pulse, whereas the heart may be very weak. The impulse of the heart against the chest walls should be carefully watched. If it is very perceptible, do not give alcohol; for as the cardiac weakness progresses, the impulse diminishes and becomes quite feeble. On auscultation, however, it can be determined exactly when alcohol should be given. In many cases of fever, only one sound can be heard, and the heart is beating 100–120 per minute. This is the second sound. The first sound is so weak that it cannot be heard; and it is the rule that where only one sound is heard, it is the second, the first having diminished or almost disappeared. This is always a dangerous condition, there being great danger of collapse; for the first sound coincides with the systole, and in proportion to its feebleness there will be weakness in the systolic contraction of the heart. At the first it may sound muffled, but as the contractions become more feeble it can only be heard by a practised ear. On the other hand, the second sound is due to relaxation of the heart. If it relaxes quickly, the sound is more clear than if gradual, and this clearness of the second sound clearly indicates the beginning of heart failure. Disappearance of the first sound always calls for alcohol, and it should be given until the first sound returns clear.

Cardiac failure in acute diseases may come on suddenly, producing syncope; unlimited quantities of brandy and ammonia should be given. It may also come on rapidly in high fever, as in typhus fever, small-pox, severe cases of measles, and occasionally in typhoid fever; in these cases, do not begin the administration of alcohol too early. It is impossible to forestall the weakness of the heart. The stimulants must be reserved for the time of actual heart failure. Cardiac failure is more likely to occur at certain hours than at others, generally after midnight, from that period till early morning. It rarely happens between 8 and 12 A.M., for usually this is the time of highest vitality. It is lowest between 2 and 6 A.M. In many cases, therefore, order stimulants to be given during the latter part of the night. After midnight, it may be necessary to stimulate till 7 A.M. The period of access of the fever is about 3 P.M. At first, the patient is stimulated by the access, and this, in turn, is followed by restlessness and delirium toward the evening, followed by exhaustion between 2 and 6 A.M. As feebleness increases, begin stimulation before midnight, then in the evening, and back through the afternoon. Alcohol should not be given right through the twenty-four hours, neither should it be given in small doses frequently repeated; this should only be done in cases of hemorrhage. It is much better to give ℥ i. of whiskey once every three hours than ℥ ij. in three hours distributed over the whole time, one good stimulation being better to tide the patient over the depression than repeated small doses.

Alcohol is of great value for its stimulating effect upon the spirits in conditions of profound nervous prostration. It should not be given unless there are signs of muscular weakness present, trembling, great depression, etc.; here it will do good.

As a Sedative.—Alcohol is one of the most valuable sedatives, in the sense that it is a brake upon the too rapid exhaustion and waste of the nervous system particularly, and here it does not act at all as a stimulant; when it does so, it produces injury.

The sedative action of alcohol is simultaneous with the stimulative, and both are felt from the moment it is taken, affecting both the sensory and motor nerves, and particularly the nerves that are concerned with the muscular balance of the body. All the automatic and the quasi-automatic operations of the body are carried on and kept in play by a continuous series of unrecognized sensations regulating these motor acts of the body, *e.g.*, the sensation of the need of breathing, by the pneumogastric nerve, etc. This sensory mechanism is very much blunted by alcohol from the very commencement. In proportion to the amount of alcohol taken, the delicacy of the sense of touch is lost. The appreciation of form is next lost, and when actually drunk it is difficult to perform any of the ordinary operations of the body, not because paralysis is present, but on account of the muscles not receiving their proper sensory impressions, and therefore not being directed with precision; consequently the unsteady gait, double vision, etc., very much resembling the symptoms of locomotor ataxia.

The sedative action of alcohol in blunting the sense of pain is also considerable, so that it is an *anodyne*, and may, on this account, be given with opium to increase its effects, and in former days this was done to prepare the patient for surgical operations. The sedative action of alcohol is of great use in those conditions in which the nervous system is wearing out from excessive irritability. It is a universal rule that nervous debility is accompanied by excessive reflex irritability. Very slight external impressions lead to motor disturbances, and this is exaggerated in disease, so that in certain conditions it amounts to the cause of death, as in tetanus, hydrophobia, strychnine poisoning, etc., when a slight touch or breath of air will throw the patient into terrible convulsions. In conditions of *nervous exhaustion*, when the patient is worn out with nervous and muscular irritability, alcohol taken in a proper manner has a remarkably quieting effect; also in conditions of *insomnia* following great muscular exertion, *e.g.*, women after parturition, who, in trying to sleep, suddenly start all over; also in women who have had the care of large families for years and who are suffering from overstrain; and to men who are subjected to overstrain alcohol should be given for its sedative effect. This enables the patient to endure fatigue, sleep well, and gain strength—not because alcohol adds anything to the system, but because it prevents waste from continual exhaustion.

Administration.—The urine can be taken as a guide as a stated fact in chronic disease; when the urine is of high specific gravity, alcohol is always contra-indicated. There is not a single condition, in health or disease, with urine of high specific gravity, in which alcohol does good; it invariably does harm. This is difficult to explain, but nevertheless it is an infallible rule. Thus, in *diabetes mellitus,* where the specific gravity of the urine runs from 1.025 to 1.050, and a great deal of nervous exhaustion and muscular weakness is present, there is apparently every reason why alcohol should be administered. Instead of doing good, however, it always does more or less harm, and seems to aggravate the disease. So also in all cases of acute disease where the specific gravity of the urine is high with high color. In cases of rheumatism where there is great depression, also in disturbed conditions of the liver, all of these, being accompanied with high specific gravity of the urine, contra-indicate the use of alcohol. But, on the contrary, when the urine is of low specific gravity, every case is benefited by alcohol, even in *Bright's disease* when it is taken so as not to irritate the kidneys. Therefore in all conditions in which the urine is of low specific gravity and of alkaline reaction—these conditions indicating the waste of the body being in excess of its nutritive power, especially nervous waste, characteristic of persons with a great deal of worry and anxiety, or who have subjected themselves to some heavy strain, venereal excesses, or, in fact, any heavy drain on the nervous system—alcohol should be given. Unfortunately there is no remedy equal to alcohol for this purpose. Generally, in these cases, the pulse is very compressible. If it is incompressible, it indicates Bright's disease.

Alcohol should always be taken with food, there being then no danger of the alcohol habit being acquired. No drunkard is a good eater. Food and alcohol are mutually antagonistic, there being hardly a case of delirium tremens in which the patient had taken a full meal for twelve to fourteen days beforehand. Many of the symptoms are really symptoms of the body demanding food. Every case of delirium tremens should be fed from the very beginning with milk, lime water, beef tea, or whatever can be taken into the disordered stomach. Every time the patient asks for drink, food should be given. Alcohol taken upon an empty stomach stops the desire for food and creates the desire for drink.

The only effect that alcohol ever has in promoting digestion is that, when taken with food in moderate quantities, it stimulates the emotions and feelings pleasurably, causing the food to digest better. This is to be explained on the principle of association. For we find that a good spirit and a cheerful frame of mind always accompany a good appetite and a healthy digestion, while dyspepsia is almost invariably associated with despondency and loss of appetite.

It is for this reason that pleasant associations and surroundings are so conducive to hearty eating and good digestion, while a gloomy atmosphere, disagreeable society, or solitude has the very opposite effect. Further, upon the principle of this association between food and the action of alcohol, we can explain the fact that craving for spirituous drinks may always be temporarily checked by taking food, and so, also, we find that persons accustomed to take alcoholic liquors only with their meals rarely become intemperate. Alcohol, as such, should never be given, but in the different preparations, of which there are a great variety in degrees of concentration, and hence divided into the mild and strong—the mild being the wines, the strong the spirits.

Wines include beers, which are virtually wines. They are all fermentative liquors, and on that account form a complex prescription, as there are other drugs besides alcohol in fermentative liquors. Wines contain tartaric acid, phosphates, ethers, and in some wines tannin, in others iron, etc. A good bottle of claret contains a large dose of the tartrate of iron.

In beers there is a quantity of nutritive albumen, so that in reality there is more nourishment in a pint of porter than in a pint of beef tea. There is a vast difference in the strength of the different preparations, wines, beers, spirits. Beer, for example, contains scarcely more than 4 per cent, whiskey 58–62 per cent. It is, therefore, impossible for these two drinks to act in the same manner. Before the alcohol in lager beer can affect the head, the drinker has to imbibe large quantities, which should rapidly pass through the system. Whiskey, on the other hand, very soon produces intoxication. Alcohol being not only a neurotic, but also a chemical, it produces coagulation of albumen and fibrin, and therefore concentrated alcohol produces changes in the stomach, liver, kidneys, and finally all over the body. This could not be done unless concentrated. There is a marked difference in diseases resulting from beer and those produced by spirits, dependent upon this chemical action interfering with the functions of the liver and leading to diseases elsewhere.

Different Preparations of Spirits.—Spirits are of different kinds: brandy, whiskey, rum, gin. *Brandy* is an alcoholic preparation, strength 56%–58% if properly made. A tablespoonful is equivalent to a little over two teaspoonfuls of pure spirits of wine or alcohol. It contains a large amount of tannin, and on this account brandy is constipative. Brandy is therefore often given as an astringent. It also acts better than any other alcoholic preparation in increasing the appetite. Hence it is a favorite addition to prescriptions containing bark or anything for arousing the appetite. It is preferable to the tinctures for this purpose. Brandy has a large variety of ethers, old brandy particularly, some of them closely approaching oil of wine itself. These give the particular flavor of each brand, dependent upon the reaction between vegetable products and alcohol in the process of fermentation. In the case of brandy, an ether is generated that is particularly good to arrest nausea, and it should therefore be given when there is vomiting with hæmatemesis. The smell of the ether sometimes is sufficient to prevent the nausea, as vomiting is more often excited through the sense of smell than by any other channel. In the vomiting attending labor, brandy should be given, and for this purpose it is preferable to whiskey, gin, or rum. California brandy is about the best.

Whiskey is the most trustworthy of liquors as to strength. It is a diuretic, and this action can be counted on pretty well. It has all the advantages of alcohol as such, except that against nausea, and it is not constipative.

Gin is still more of a diuretic, from the juniper berries. It is also an antispasmodic, on account of the ethers it contains. It is much used to relieve spasmodic pains of the genito-urinary system, but it increases the pain when due to gravel. *Rums* are made from fermented molasses. Gin, whiskey, or brandy can be used with milk as stimulants.

Wines.—Wines differ in amount of alcohol and saccharine principle. When the ferment and saccharine elements are equal, the wine is said to be "dry," while when one or the other is in excess a sour or sweet wine results. Wines are divided into strong and light wines. Strong wines are those which are so concentrated as to range from 18%–22% of alcohol. The sweet wines are produced from very saccharine juices of grapes, and hence are from the warmer climates. Sherry (Spain) and port (Portugal) are types of this class. The malt liquors are fermented liquids produced from grains; they are wines. Their strength varies: lager beer, 2%–6% alcohol; English ales, porter, and brown stout, 6%–12%. The light or sour wines are the weakest, as clarets, hocks, etc. In these, the percentage of alcohol is from six to twelve. The clarets ought to be made from black grapes, and the juice of these includes the coloring matter and a portion of the extractives from the skins, so that they are red. Light hocks are derived from white grapes or black ones without the skins.

Now, as to the choice of the different preparations, when we wish to use alcohol as a sedative, there is no rule but one—that is, the patient's own experience. With a great many, spirits will be much the best; with others, wines; with others, beers. If any of these affects the head, alcohol is not indicated at all, or not in that particular form. The effect upon the head should be the guide. Women, as a rule, cannot take alcohol unless in combination. It goes to the head, causing a sensation of heaviness, etc. This indicates that even a teaspoonful is too much. Wines, as found in this country, are very rarely the juice of the grape alone and the product of its fermentation. They all contain brandies or free alcohol, in order to preserve them from further fermentation. As has already been said, any free alcohol is very certain to affect the heads of most women and of some men, and hence wines containing free alcohol act more as drugs than as wines. The royal tokay California wine is to be preferred; it can also be given to children. No kind of drink whatever, whether it be wine, tea, or coffee, should ever repeat, *i.e.*, be tasted again, and this should be the answer to questions as to whether any particular drink may be taken. So with articles of food.

The difficulty with beers is that when they do not agree they irritate the skin, and both wines and beers, when taken for a long time, are prone to produce gout. If there is any tendency to kidney trouble, as gravel, etc., anything in the form of beers or wines should not be prescribed; nor if there is any tendency to eczematous troubles, which are frequently dependent upon fermentation in the stomach.

Acute alcoholismus occurs generally in those who go on a prolonged spree after a period of abstinence from intoxicating liquors. It is a real paroxysmal disease, like epilepsy; the attacks become more and more frequent, the interval between them decreasing.

Hereditary tendency has a great deal to do with the etiology, children of drunkards have a tendency to insanity. The paroxysms occur especially in those who are highly gifted and talented. They will drink in secret, and cannot be restrained by any influence. When the desire for drink comes on, the appetite is lost; no remedy can control the craving except veratrum viride, which should be given in five-drop doses of the tincture until nausea is produced. There is generally great tolerance of the drug in these cases. The nausea supplants the thirst better than anything else except food, but these patients refuse to take the latter. The symptoms of an impending attack are an increased pulse and high arterial tension.

When a large amount of alcohol has been taken in a short time, *acute alcoholic poisoning* may result. The symptoms of this condition are: coma, relaxation of the entire muscular system; pulse is hard, rapid, and strong. This may develop into convulsion, epileptic in character, resembling puerperal eclampsia. The face becomes blue, the heart very rapid. To save the patient, either bleed until the pulse becomes soft and patient shows signs of consciousness, or administer tr. veratrum viride in drachm doses until the same effect is produced. There is no danger of veratrum poisoning.

Chronic Alcoholic Poisoning.—1st. *Delirium tremens* always follows prolonged drinking without taking food. It is produced by alcohol following starvation, and will not occur unless the patient has been without food for ten days or two weeks. He should be forced to take food.

2d. *Alcohol Habit:* Patients suffering from this habit complain of gastric troubles. There is loss of appetite, especially in the morning; animal food is distasteful; there is pain on pressure over the stomach

The bowels are constipated, and movements are scanty and dry. Tongue is brown at the back and dry, with red tip; the red line continues on the fauces. There is also chronic pharyngitis.

The hands are fat, flabby, and soft. Sleep is disturbed characteristically; the patients sleep well the first part of the night, but wake about 3 A.M., and are unable to sleep again, or, if they do, are troubled by unpleasant dreams.

Constant and excessive use of alcoholic stimulants ages the drinker in all respects. He becomes an old man before his time; the skin becomes dry, with soft, unhealthy, waxy feeling. The mind becomes sluggish and weak. These changes are due to a sedative action of a paralytic character.

III. Ethers.

Ethers are agents generated by the action of an acid upon alcohol. There are a great variety, but those used in medicine are few. Used as medicines, they have properties similar to those of alcohol, only more rapid and evanescent [illegible] possess properties distinct from alcohol. Thus *sulphuric ether*, when taken into the stomach, produces a sensation of warmth, as alcohol does; along with this, the heart begins to beat rapidly and strongly, and its action is still further characterized by dilatation of the arterioles all over the body. Hence every one of the ethers, taken in sufficient doses, is a decided diuretic, producing warm perspiration. Some of them act upon other secretions, notably sulphuric ether, which is a good *cholagogue;* and all of them, but particularly sulphuric ether, are very efficient in arresting the spasms of ducts in the intestine, the gall bladder, etc. They are the most valuable medicines of the neurotic class for this purpose.

Spirit of Nitrous Ether.

Sweet spirit of nitre has a special effect upon the kidneys. It is more of a diuretic than sulphuric ether; it is also a very good agent to relieve spasm of the ureter, and, to a less degree, of the bladder and urethra. Hence it is often given to relieve the pain caused by renal irritation, and is of service in conditions of congestion of the kidneys; besides this, it is an admirable diaphoretic.

It can also be used in *bronchitis* with pain and soreness in the chest, especially in children.

Chloric Ether.

Chloric ether, or spirit of chloroform, is not used very much at the present time. It is very good for allaying irritability of a sensory kind producing nausea, and so can be given in the *vomiting of pregnancy,* also in *intestinal colic;* a few drops given with glycerin have the same effects as Hoffmann's anodyne.

Spiritus Ætheris Comp.

The compound spirit of sulphuric ether, or Hoffmann's anodyne, is a combination of sulphuric ether with alcohol and the heavy oil of wine. All ethers are of very low specific gravity and very volatile when pure. Alcohol, when added to them, lessens their pungency and develops their power. The oil of wine is an extremely valuable *antispasmodic.* This preparation is the best of all the ethers for the relief of pain that is paroxysmal in character, due to the spasms of ducts. It can also be given for the relief of *asthma.*

The oil of wine is very expensive, and on that account in some cases is not added; so, also, with the sweet spirit of nitre and compound spirit of sulphuric ether. Squibb's preparations can be depended upon, however.

Ethers are of some importance in the treatment of *Bright's disease.* The nitrates are a class of medicines that have very decided effects in relieving or in preventing spasm of the unstriped muscular fibres. Arterial spasm is caused by certain poisonous products in the blood, and, as a result of this chronic contraction, enlargement of the heart takes place, and in the kidneys themselves this persistent tonic contraction leads to low specific gravity of the urine, clearly indicating that materials that ought to be excreted are retained in the blood. In spasmodic or irritable stricture of the urethra, great difficulty is sometimes experienced in the introduction of a sound; in which case, placing the feet in hot water, the administration of a full dose of chloric ether, and the injection per rectum of ten drops of tincture of aconite in an ounce of warm water, will often relax the spasm, so as to admit of the passage of the instrument or to render the operation unnecessary. The muriated tincture of iron contains chloric ether, and may be used in urethral spasm.

Ammonia and ethers combined are used for the relief of *trigeminal neuralgia,* occurring in anæmic persons and due to feeble circulation.

THE MYDRIATICS.

The mydriatics are a class of medicines bearing close resemblance to each other, and take their name from the fact that their most characteristic effect is marked dilatation of the pupil. The most important members of this class are belladonna, hyoscyamus, and stramonium. These drugs come from one particular family of plants called the solanaceæ.

IV. Belladonna.

Belladonna is the best type of this class. The action of these medicines can be explained by their innervation of the rhythm of involuntary muscles (voluntary muscles do not act rhythmically). The action of involuntary muscles consists in a wave beginning at one end, and proceeding in a wave through the whole length of the muscle. There is one peculiarity about the arrangement of rhythmical muscles—if in a state of spasm, instead of the whole muscle being affected, one half sometimes will be contracted and the other half paralyzed or relaxed. In studying their arrangement, when they surround tubes we find that some of their fibres run lengthwise and some transversely; hence when a tube—*e.g.*, the intestine—is in a state of spasm, one part will often be contracted, and next to it there will be a dilated or relaxed part. Cramps are often present, due to the fact that the air passes first into a constricted part and then into a dilated part. This alternate contraction and relaxation produce various rumbling sounds in the intestines. What belladonna and the other members of this class do is to act in restoring the normal, vermicular, steady rhythmical action of these muscles. Unstriped muscular fibres are always found in the tubular or involuntary muscles, never in the voluntary or skeletal muscles.

The tubular structures, as the arteries, etc., in large divisions if not in small ones, have a muscular coat; besides, there are a number of hollow viscera which are really dilatations of tubular structures, *e.g.*, the stomach, the bladder, and the heart. Hence many diseases of the heart we now know to be due to the fact that the blood-vessels are affected, which react upon the heart and hence involve the whole mechanism. Therefore, in heart disease it should be remembered that the arteries are a part of the same apparatus, and that many affections of the heart are dependent on their action. This explains the good effect of belladonna in heart disease. Rhythmical muscles are to be found lining all the tubes and viscera; belladonna and its allies restore the natural action of the muscular layers.

The bronchial tubes are sometimes affected in their rhythm by a purely nervous disease. In *asthma*, there is a cramp of the finer bronchial tubes in the same way as already described—not the entire tube, but certain portions of it: one part is contracted and the other is dilated or relaxed; hence the air, in passing through, gives rise to a musical, sibilant, or whistling sound. Belladonna arrests the spasm by restoring the natural rhythm, and as soon as this is done the contracted parts relax and the dyspnœa disappears. Asthmatic breathing is very different from other kinds of dyspnœa which are very often confounded with it. There is one unmistakable sign which, if not present, shows that the disease is not asthma: that is, difficulty in expiration. The air goes into the lungs with comparative ease, but the patient cannot drive it out again so readily, in marked distinction to normal breathing, in which inspiration is three times as long as expiration. In asthma, the conditions are reversed. Belladonna and its allies, for the time being, relieve the spasm; but as they are neurotics, whose functions are to relieve symptoms only, they cannot cure the disease. The symptoms are relieved, but the asthma itself is not in any way benefited.

It not infrequently happens that persons of a nervous temperament are troubled with a choking sensation, as if some foreign body were lodged in the œsophagus. This is a real "globus hystericus," even when occurring in males, and indicates that there is a spasm of the œsophagus. A large quantity of saliva collects in the dilated portion during the night, and is raised in the morning. Belladonna will relieve this condition, if it is not due to serious structural disease. This condition usually ends in irregular contraction or cramp of the stomach. In all cases of *dyspepsia, nervous, irregular action of the heart, palpitation, severe stomach-ache,* it is an indication that whatever is given must contain belladonna. In *gastrodynia,* it should always be tried, not only with tonics, but with bismuth, pepsin, and resorcin.

In chronic constipation of women, there is a peculiar tendency, when the ovarian plexus is irritated, to paralyze the peristaltic movements of the intestines. In dysmenorrhœa or a tendency to amenorrhœa, there will be obstinate constipation, due, in a great part, to the irregular contraction and spasm of the intestines. If this condition lasts for any great length of time, during a paroxysm borborygmi will be developed; this is due to a running sort of contraction and relaxation of the intestines. This reflex nervous disturbance is one of the commonest causes of constipation in women, and hence belladonna should always be added when a laxative is to be given.

℞ Extracti Belladonnæ, ...	gr. v.
Extracti Nucis Vomicæ, ...	gr. x.
Extracti Colocynthidis Comp., ...	ʒ i.
Liquoris Potassæ, ...	gtt. l.

M. et ft. pil. No. xx. Sig. One at night.

On the same principle, belladonna and its allies are of great value in the treatment of *cystitis*. The bladder, when irritated or inflamed, acts in a spasmodic way, expelling its contents. The principle is to give rest to the part, as every movement aggravates the inflammation. Belladonna here relieves the spasmodic action very markedly, and should therefore be given. If the muscular fibres of the bladder have lost their tone, the bladder is of course weakened, and belladonna should not be given. This is the case with old men, who are often troubled with obstruction due to an enlarged prostate gland; the bladder, retaining its contents, loses its power of expulsion, and hence must be emptied very frequently, because it is virtually a very much smaller one, only the upper part being capable of expelling its contents. In this case, if belladonna should be given the patient could not empty the bladder at all. Belladonna simply allays the spasmodic irritation, and is not a stimulant to the bladder itself. Overdistention frequently happens during the process of parturition, and is always a serious matter, for it is a rule that unstriped muscles, if overdistended or stretched, never recover their normal condition again. The patient should not go for more than three or four hours after parturition without micturition. Four women out of five who have borne children have difficulty in emptying the bladder, due to this one cause. In these cases, belladonna should not be given, but instead of it give nux vomica and perhaps add ergot.

Nocturnal incontinence of urine in children is generally due to irritation of the bladder, causing it to expel its contents as soon as it has become filled to a certain degree, provided this is not prevented by a direct act of the will. Belladonna will often effect a perfect cure in these cases, but it must be given in sufficient quantities to secure its full physiological effect *at night.* It should cause flushing of the child's face while he is awake. Combining it with chloral and ergot may be beneficial.

The Vascular System.—It is of special use in certain affections of the heart in young persons who have had rheumatic endocarditis. Very often, in a year or two, there will be dilatation of the left chamber of the heart, with severe pain on exertion; this is due to want of balance in the rhythm of the two sides of the heart. In cases of *cardiac pain,* confined to the heart itself, with rheumatic history, etc., a belladonna plaster can be applied and belladonna itself given internally; it can be combined with iron and given in pill form. The pain of *angina pectoris* is not confined to the region of the heart, but radiates down the left arm ; the latter pain is not relieved by belladonna, but by nitroglycerin and other cardiac stimulants.

Glandular Secretions.—Belladonna arrests certain normal secretions of the body. It is the most reliable drug to check the secretion of milk, and should be given for one or two weeks continuously. If, therefore, a woman expects to be confined, and knows that she cannot nurse her child, belladonna should be administered before parturition. By some it is claimed to be a good remedy for the tediousness of the first stage of labor. Be this as it may, it will certainly cause milk to dry up without forming abscesses. The internal administration of the drug is to be preferred in these cases. However, if promptness is essential, apply locally; but poisoning sometimes results from its application to the breast, where the skin is very thin and absorbs readily, the constitutional effects of the drug being sometimes produced. The officinal ointment is to be preferred. Excessive sweating in the armpits and the feet may be checked by the application of the ointment of belladonna. If, however, it is general, as in phthisis, belladonna should be given internally in the form of the tincture or the solid extract.

Preparations.—Tinctura Belladonnæ (dose, ♏ x.); Extractum Belladonnæ (dose, gr. ¼).

The alkaloid atropia is very powerful, and is used almost exclusively for making solutions to dilate the pupil for examination of the eye, being superior to belladonna itself for this purpose.

SUMMARY OF THE USES OF BELLADONNA.

1. In bronchial spasm and asthma.
2. In spasm of the œsophagus, dyspepsia, cardiac palpitation, and gastrodynia.
3. In chronic constipation of women.
4. In cystitis.
5. In cardiac pain.
6. For arresting glandular secretions.
7. For nocturnal incontinence of urine in children.

Hyoscyamus.

Hyoscyamus has the properties of belladonna and no other. There is no difference between them except in activity. The extract of hyoscyamus is a very uncertain preparation, and cannot be depended on in all cases, compared to the true and well-known dose of belladonna. Its alkaloid, hyoscyamine, however, is very powerful, more so than atropine. There is virtually no difference in action between the two.

Stramonium.

Stramonium is the leaf of a weed found all over the United States. These leaves are dried and broken up in the same way as tobacco, and used in the same manner, viz., by inhaling the smoke. This smoke inhaled into the bronchial tubes produces an immediate effect upon asthmatic paroxysms, more than when atropine or belladonna is taken internally, and hence it is used almost entirely for this purpose. All of this class are good anodynes for the relief of pain in fibrous tissue, and notably where the pain is due to overstretching. Against a sprain belladonna or stramonium is more effective than opium; hence when there is inflammation or injury involving fibrous tissue, the addition of either of these two medicines markedly increases the action of opium, and opium helps them also. On account of this anodyne action, atropine and morphine should be given in *sciatica*, and also in sprains in the back from lifting. In sprains about the ankle, etc., an ointment of atropine and morphine should be used.

V. Cannabis Indica.

The flowering tops of the female plant of Cannabis sativa, which grows in the East Indies.

Indian hemp does not affect all persons similarly, and race and climate are supposed to modify its influence. Its effects are most marked on the brain, whose functions it more or less perverts in various ways. It generally produces a pleasurable intoxication. The patient is possessed with a feeling of happiness and contentment, and ideas of a pleasing kind pass rapidly through the mind, sometimes unconnected and immediately forgotten, but in some instances recollected on the return to the normal state. Sometimes there is furious delirium. The eyes are bright and shiny. Pressure on the skin may excite a sensation of burning. After a time, complete anæsthesia sets in to such an extent that while standing there may be no consciousness of touching the ground. If indulged in for a long time, as is common in the East, it produces loss of appetite and strength, trembling, and much mental weakness.

Dilatation of the pupil and disorders of vision, which contribute to the hallucinations by the distortion of external objects, are produced by Cannabis Indica. It has been employed to relieve pain, and as a substitute for opium in *neuralgia* and as a *hypnotic.* It is a valuable remedy for *migraine,* or sick headache. It appears to act upon the nervous system, from whence this headache is derived. It is useful in those cases accompanied with little or no nausea, or in cases with severe vomiting; it is also useful in those attacks accompanied with spectra. It is well established that hemp has the power to promote uterine contractions. It does not cause them, but it increases their energy when action has begun. Cannabis Indica is useful in *menorrhagia,* and especially in that form which occurs at the menopause. It is also useful in cases of functional impotence, and may in this disease be combined with ergot and nux vomica. In some cases, it acts well as a diuretic, and hæmaturia is a special indication for its use. It can also be employed in *dysuria* and *strangury,* and is useful in retention of urine dependent on paralysis of spinal origin.

Preparations.—Extractum Cannabis Indicæ (dose, gr. ¼–ij.); Extractum Cannabis Indicæ fluidum (dose, ♏ ij.–iv.); Tinctura Cannabis Indicæ (dose, ♏ vi.–xxx.).

(*b*) *Those Medicines which are Stimulants only.*

1. Digitalis.
2. Strophanthus.
3. Nitroglycerin.
4. Caffeine.
5. Ammonia.
6. Ergot.
7. Strychnine.
8. Camphor.
9. Asafœtida.
10. Valeriana.

I. **Digitalis** (Foxglove).

The leaves of Digitalis purpurea, from plants of the second year's growth. Digitalis is a biennial plant, indigenous to southern and central Europe, particularly in the western section, and grows wild as far north as Norway, likewise in Madeira and the Azores. It is a cardiac stimulant, and is given for the purpose of increasing the contractile power of the heart and to cause it to recover as far as possible, even in organic changes, its natural size.

Digitalis is a very old remedy comparatively, and in former days it was noted that its action was to slow the heart if given continuously, and also to make the heart beat intermittently, and so it was classed as a pure heart sedative. This was previous to the careful studies of physiologists in their experimentation on animals. When we have a living heart exposed, to watch the effects of digitalis, we find that it produces a peculiar tonic contraction of the heart, particularly of the walls of the ventricles. The contraction is not uniform, but cramp-like, not all of the fibres of the heart equally participating; and so the heart presents a streaked or nutmeg appearance, as it is called, owing to the contracted fibres turning pale, those not contracted remaining relatively redder. This contraction is mainly due to the prolongation of the systole at the expense of the diastole. Digitalis increases the systole at the expense of the diastole, and if given continually, even where there is a normal heart, causes death by increasing the systole without any subsequent diastole or relaxation, the heart cavities growing smaller and smaller. This demonstrates the uses and dangers of digitalis, and explains, when acting as a poison, one symptom particularly, namely, the intermittency of the pulse, because the heart does not relax and skips a beat. With this condition there is persistent and dangerous nausea and vomiting.

The cumulative effects of digitalis are sometimes produced where, after the drug has been taken for a number of days, there will be persistent nausea and vomiting, often lasting for several days. In some cases, it will appear almost impossible to discover the cause of the vomiting until the intermittency of the pulse leads to the suspicion of digitalis poisoning. Hypodermatic injections of morphine should be given. The vomiting is caused by cerebral anæmia, and should be counteracted by morphine, because it produces relaxation of the heart.

Digitalis is therefore the medicine for *dilatation of the heart* due to the relaxation of its muscular walls beyond their normal capacity. It is not a loud murmur that indicates great danger, as heart disease of a valvular kind never gives any trouble until the heart is not able to empty itself at each stroke. When this happens, then commences the general systemic disturbance of the circulation. When unable to wholly expel its contents, the heart becomes much dilated, and here a remedy is needed that shall contract the heart enough to bring it back to its natural size. Digitalis does not increase the contractile power of the heart in the way that alcohol and ammonia do, but the heart remains permanently smaller so long as it is under the effects of digitalis. This explains its whole action. It is not a cardiac stimulant in the sense that ammonia, alcohol, and brandy are, yet it is often given by physicians in the most routine way in pneumonia or typhoid fever where the danger is not of a dilated heart, but of a weak heart. Where the heart is only weak and not dilated, digitalis does no good. Apparently, therefore, digitalis is a typical medicine for dilatation of the heart; but, unfortunately, it has another effect, namely, it contracts not only the heart, but also the muscular coats of the arteries: not the aorta—for there the coat is elastic—but the small arteries, and the smaller they are the more they feel the effect of the drug. How does it do this? On the coats of the arteries the vaso-motor nerves are distributed, and wherever there is a division of the artery, there we find a little ganglion, and at the next division another little ganglion of the vaso-motor system, and so on. These ganglia, instead of being acted upon all at once, are sometimes acted upon from the periphery, as in Bright's disease, or, as when digitalis is administered, from larger ganglia downwards. So in the latter case we find that when the heart is through with the action of digitalis, the little arteries are not, and so there is an obstruction which undoes all the good obtained from digitalis in strengthening the heart. The addition of nitroglycerin, however, overcomes this arterial obstruction, and we lose nothing of the action of digitalis on the heart in combining these two drugs with strophanthus, as nitroglycerin itself is a cardiac stimulant. The combination of these drugs is very gratifying in its effects in all cases of heart failure due to obstruction of the circulation. It can be given also in *angina pectoris,* many of these cases being due to chronic obstruction in the arterioles, the heart being simply tired out from endeavoring to overcome this obstruction. Another of the actions of digitalis equally beneficial is in treatment of *chronic Bright's disease,* where there is serious disturbance in the circulation over the whole body, due to *toxæmic poisoning* irritating and contracting the arteries. This disease, with sometimes one exception, namely, amyloid degeneration, gives a characteristically small, incompressible pulse. Here digitalis may be given to enable the heart to overcome its great tax of contracted arteries and the dilatation going on from constant obstruction. Digitalis should be given for the heart and nitro-glycerin for the arteries. Under this treatment Bright's disease shows decided symptoms of improvement, there being less albumin in the urine, with higher specific gravity.

The following can be used for chronic Bright's disease:

℞ Hydrargyri Bichloridi, ...	gr. i.
Pulveris Digitalis, ...	gr. xxiv.
Quininæ Sulphatis, ...	gr. xxiv.
Massæ Ferri Carbonatis, ...	ʒ ij.

Misce et fiant pilulæ No. xlviii. Sig. Two pills t. i. d. after eating.

Digitalis is also a diuretic of a kind which can be given without fear where there is engorgement or congestion of the kidneys from acute nephritis. It is the remedy, therefore, in the nephritis of scarlatina, where a saline diuretic cannot be given, nor an irritant diuretic like ether or turpentine. The reason why digitalis can be given is that it produces the same kind of change in the circulation of the kidneys that occurs whenever there is a shock given to the whole arterial system. It operates on the kidneys, therefore, in the same way that fear does. When a man is frightened, the heart contracts, also intermits; he is nervous, cold, turns pale—all indications of vaso-motor spasm, producing a diuretic effect, as is frequently shown by incontinence of urine. Digitalis acts much in the same way in certain conditions of hysteria, and in spermatorrhœa due to weakness and debility. A stimulant of this kind produces a contraction of the arteries of the part. In epilepsy, there is one curious condition where digitalis does good, namely, where there is more or less intestinal disturbance and the patient has a bad breath, either before or during the convulsions. Anything like this should always be inquired for, also if there is diarrhœa or obstinate constipation accompanying, preceding, or following the convulsion. These peculiarities are often due to intestinal fermentation and the resultant poisoning. Digitalis always does good here, of course combined with other things.

Finally, as to its action in *pneumonia*. In typhoid fever, it is of no use at all. Never give it in diphtheria, worse results possibly following from its administration than from the disease itself, because it interferes with the peripheral circulation, which is the first thing that fails in prostrate conditions of heart failure. Nor should it be given in fatty degeneration of the heart, where it does no good. But in certain conditions of pneumonia it does a great deal of good, namely, where the right side of the heart is embarrassed and there is danger of death from its being unable to drive the blood through the lungs; this rarely happens until the temperature falls, and hence this is the indication for giving digitalis, and at the same time iron in large doses. Therefore, when the patient has a low temperature coming on instead of high; if he turns blue, particularly if the lips turn blue when the patient is turned over from side to side, or if foolishly raised when the pulse is weak, these are very grave symptoms of prostration, because the right side of the heart is dilated and exhausted with its futile efforts to drive the blood through the lungs. Then it is that digitalis with oxygen gas and iron may be given with great success. Cases of *alcoholic pneumonia* are most likely to produce this condition. In acute pneumonia with high temperature, it should not be given, because here the heart is not dilated.

Digitalis should not be given for weak heart simply, not being a tonic in that sense, but only in cases where the heart is dilated either temporarily or permanently. In fevers, on the other hand, where the danger is of the patient dying from heart exhaustion, in the fatty state produced by the febrile process (fever is now considered to be a trouble of the muscles, heat being generated there in excessive amount), digitalis is not only useless but positively mischievous. To overcome the arterial obstruction caused by digitalis, combine it with nitroglycerin and strophanthus, which forms practically a new medicine. (We now know that hypertrophied muscles have a greater tendency to fatty degeneration than natural muscles; this is to be borne in mind, for, consequently, when the heart hypertrophies there is a greater tendency to fatty degeneration. In one of the English manufacturing towns, where there is a large class of artisans engaged in hammering brasswork, there is found in many of them hypertrophy of the biceps muscle owing to their occupation, and a large number of cases have total atrophy. Apparently the hypertrophied biceps becomes more prone to fatty degeneration.)

Preparations.—Pulvis Digitalis (dose, gr. i.); Extractum Digitalis (dose, gr. ¼); Infusum Digitalis, ʒ i.–Oss. (dose, ʒ i.–ʒ iv.); Tinctura Digitalis, ℥ ij.–Oi. (dose, ♏v.–xx.; Extractum Digitalis fluidum (dose, ♏i.–ij.).

The tincture is not always reliable. The best preparations are the infusion freshly made from the English leaves, and Squibb's fluid extract.

II. Strophanthus.

Strophanthus hispidus is an African plant found both on the western coast of the continent of Africa, in Senegambia and Guinea, and on the eastern coast along the Zambesi River; its alkaloid is one of the most virulent poisons known, and is used by savages on the coast of Africa for poisoning their arrows. A dose of one two-hundredths of a grain is sufficient to kill a strong dog. It is given only in the form of a tincture. Its operation is more definite than that of digitalis, if it is a good preparation. Unfortunately, however, it is difficult to obtain a good preparation of uniform strength, but when its alkaloid becomes cheaper we may be able to use that. At present, we have to rely upon the tincture, and of a good preparation of this medicine the dose for an adult ought to be four drops, from that up to ten, but not beyond. The action of strophanthus has been very thoroughly studied. It has the following excellent properties: it is a stimulant of the same nature as digitalis, so far as the heart systole is concerned, producing a strong, steady, uniform systole, and it also interferes with the diastole, but not to the same extent, as it does not produce intermittency except when given in large doses. Its chief value is that it does not contract the arteries and raise the blood-pressure to the same extent, or so soon, as digitalis. Strophanthus is, therefore, one of the best medicines for use in heart failure, and, on the whole, is to be preferred to digitalis for this purpose. There are two forms of heart failure: one from muscular overexertion, the other from inherent inability. Of the former, we have failure from valvular or chronic arterial disease; of the latter, we have many cases where there is no hypertrophy and no dilatation, and so we ascribe the heart failure to simple deficient innervation (this trouble has increased very much in the past ten years). One of the signs of heart failure is palpitation. In many cases, the heart, instead of failing at once, commences with weakness, indicated by irritability, causing palpitation. There are some diseases in which palpitation, as such, is very distressing; for instance, in Basedow's or Graves' disease, where commonly we have enlargement of the thyroid gland, and with this excessive nervousness, excessive rapid action of the heart causing a visible throbbing of the arteries all over the body. Its exact cause is not known, but it is thought to be due to poisoning from fermentation in the intestines. In hysterical, nervous persons with dyspepsia, there is frequently palpitation without murmurs or valvular disease, and this is evidently due to deficient power of the heart, caused by paralysis of its inhibitory mechanism. The strength of the heart is shown, not by its rapid beat, but, on the contrary, by the ability to restrain it from beating too fast in conditions of nervous disturbance or in great emotion. Where the palpitation is due to great sensibility to nervous emotion and nervous irritability, and to vaso motor disease, strophanthus is the best remedy by far that is known. Strophanthus increases the power of the heart's action, and does not have the same effect in raising the tension of the pulse by interfering with the calibre of the small arteries, and is of special use where the heart is weakened from nervous causes, as in functional palpitation (the majority of these cases, however, are due to intestinal fermentation, and should be treated dietetically and by intestinal antiseptics). In strophanthus, we have the best remedy for functional palpitation of the heart, and it is a great adjuvant to digitalis, and is frequently combined with it in the treatment of heart failure in *pneumonia* and in the treatment of *cardiac dropsy*. We have other agents that have the same power to assist a failing heart, and one is nux vomica. This added to strophanthus works in the same way that a small dose of ipecacuanha added to opium acts as a diaphoretic. Nux vomica by itself is not a pronounced cardiac stimulant, but added to strophanthus it increases the power of the latter, and conversely. In dropsical disease of the liver due to weak heart, a form that occurs whenever there is regurgitation on the right side, the person becomes jaundiced, has gastritis, this combination is useful.

III. Nitroglycerin.

The action of nitroglycerin as a medicine is extremely rapid. Given in proper medicinal doses, it operates as quickly as ether, the first effect being a rapid dilatation of all the arteries, producing an uncomfortable sensation about the head, similar to that produced by alcohol or by some great mental emotion. Pain is a prominent symptom; the eyes are suffused, there is ringing in the ears, etc. The heart begins to beat quickly with powerful contractions, similar to those produced by alcohol or ether.

Nitroglycerin is an extremely valuable medicine in *pneumonia*, for in this disease the great danger is from arrest of the circulation in the lungs, where the circulation suddenly ceases in one part of the lung; the remaining portion, being unable to adapt itself to the sudden change, becomes highly embarrassed, congestion and pulmonary œdema take place, and this condition affects the heart, embarrassing that also in its action, and, as the result, the patient sinks from great prostration.

The stimulating treatment of pneumonia by large doses of the carbonate of ammonia and alcohol is often discouraging.

The treatment of the present time consists in giving digitalis and strophanthus in small doses to increase the systolic power of the heart. Unfortunately, with both of these agents, and especially with digitalis, nothing is gained ultimately, for, although the heart is strengthened, the arteries are contracted and the extra strength of the heart is expended in overcoming the increased arterial resistance, the one balancing the other. In all these cases, nitroglycerin should be combined with digitalis and strophanthus. In cases of pneumonia with high fever and no indication of heart failure, aconite should be given; five drops of the tincture of aconite with ʒ i. doses of the sweet spirit of nitre every two or three hours, according to the urgency of the symptoms. As soon, however, as the respirations begin to increase and the pulse becomes weak and irregular, commence with cardiac stimulants, strophanthus, digitalis, and nitroglycerin, to be administered together, and, if occasion demands, these remedies should be pushed.

As has been already said, nitroglycerin has a special power of relaxing the arteries, which property it has in common with the nitrite of amyl, but the former is more permanent. Hence it is the medicine for ***high arterial tension,*** which indicates that the calibre of the arteries is diminished, and we infer from this that the trouble is in the small arteries throughout the body, producing a tendency to dropsy, due to the venous current not receiving proper impulse, and hence the serum of the blood exudes into the surrounding tissues. This will be most apparent where the veins are not pressed upon to any extent by muscles and not provided with valves; hence in *Bright's disease* the face becomes puffy, etc. This condition will lead to heart disease, first hypertrophy, then dilatation, owing to the increased amount of work imposed upon the heart in driving the blood forward. Hence in Bright's disease, and in all diseases of the heart due to hypertrophy first and dilatation afterwards, nitroglycerin should be used for the purpose of dilating the arterioles, and thus relieving the heart of much of its burden of work; consequently it is a great adjuvant in the treatment of *anasarca,* and also of great benefit in increasing the power of the kidneys to excrete urea and diminish the amount of albumin in the urine, notably in the chronic interstitial form of Bright's disease with a hard, incompressible pulse.

Nitroglycerin is a medicine which, like all powerful neurotics, acts differently upon different persons, there being many so-called idiosyncrasies to take into account in administering it, some persons being unable to take even extremely minute doses, while others can take comparatively large ones with impunity.

The dose to begin with should not exceed gr. $\frac{1}{100}$, and if disagreeable symptoms are produced the dose should be reduced to gr. $\frac{1}{200}$. Usually, however, gr. $\frac{1}{100}$ is well borne, and after a time the dose may be increased to gr. $\frac{1}{75}$ or gr. $\frac{1}{50}$. In some cases of chronic Bright's disease, it may be necessary to increase to gr. $\frac{1}{30}$–$\frac{1}{20}$ or even to gr. $\frac{1}{10}$.

The pain of *angina pectoris* is greatly relieved by the administration of nitroglycerin. If it is the first attack (this disease is dangerous from the very first, death resulting in some cases from the first attack), the nitrite of amyl should be given by inhalation; five drops can be inhaled, the nitrite of amyl being more rapid in its action than nitroglycerin. Angina pectoris is a severe neuralgic pain in the heart, and very frequently muscular spasm of the heart due to overwork. Any muscle when cramped gives rise to a severe pain, owing to the pressure upon the nerves caused by the muscular contraction. In angina pectoris, the patient feels as if he was going to die; the pains radiate to the left arm. This symptom should always excite suspicion. Pain over the region of the heart is not comparatively of much account unless it radiates to the arm, and then the cause of pain is in the heart itself.

In some instances the pain radiates to the right arm and also into the neck, but generally it is felt in the left arm. Therefore any cardiac pain caused by valvular disease radiating into the left arm will be relieved promptly by the nitrites, nitroglycerin and nitrite of amyl. The arteries should be carefully examined; if high tension with rigid arteries be present, give nitroglycerin t. i. d. with iron as a cardiac tonic, and prohibit the use of nitrogenous food; meat, when taken largely, having a tendency to aggravate the rigidity of the arterioles.

The patient should be placed in the open air as much as possible. In *headache* combined with coldness of the surface of the body, pale face, pulse small and sometimes incompressible, nitroglycerin often does good.

Tinnitus aurium, which sometimes is an extremely obstinate and distressing complaint, in a few cases is relieved by nitroglycerin.

IV. Caffeine.

Coffee is indigenous to tropical Africa, more particularly to Abyssinia. It grows wild in Central Africa and on the coast of Mozambique, and was introduced into Java near the close of the seventeenth century, and into the West Indies and South America during the eighteenth century. Caffeine is an alkaloid which is at the base of tea, coffee, cocoa, etc. It is very widely dispersed and possesses curious effects, both chemically and physiologically. Coffee is allied to uric acid so closely that it can be made from it; hence it seems as if man has been using materials allied to those found in the body due to the retrograde metamorphosis of the system; for uric acid is an irritant, producing gout where there is an excessive quantity of it. Large quantities of tea, coffee, etc., will also aggravate a gouty condition. Caffeine markedly increases the stroke of the heart by increasing its contractile power. Hence it is good practice to keep up the effectiveness of neurotics by using them interchangeably. Where digitalis, strophanthus, or the other remedies are losing effectiveness, one-, two-, or three-grain doses of caffeine may be used for a time instead. In some cases, it is not borne in larger doses than one grain. If not well borne, the symptoms are tremor of the muscles, similar to that produced by excessive use of tea or coffee, and the patients feel uncomfortable about the head. Generally begin with one grain of the citrate of caffeine and increase to two or three. It is also very good in *asthma*, particularly where there is a good deal of bronchial congestion, in which patients raise a considerable amount of watery expectoration after the asthmatic attack. Not uncommonly these are cases of chronic asthma where there is some emphysema and weakness on one side of the heart.

Lastly, there is a mineral, proved to have an action on the heart similar to that of digitalis, viz., **chloride of barium.** It is quite a powerful poison in large doses. Not more than one-fourth of a grain should be given. Some cases of heart failure are quite susceptible to the action of barium.

Therefore, to sum up, there are six great medicines for palpitation of the heart, both with and without dropsy, producing effects upon the portal circulation, heart weakness, and heart failure, which are shown by a tendency to palpitation; these remedies are, **digitalis** to lead, **strophanthus, nitroglycerin, nux vomica, caffeine**; and to these vegetable remedies should be added the mineral **chloride of barium.** All these remedies sooner or later disturb the stomach by interfering with the patient's appetite. There is repugnance of food, and later on nausea and vomiting, and when this sets in it is very difficult to control. As soon as the patient becomes nauseated, their use should be intermitted for a good while, as the stomach has strong prejudices, and it may be some weeks before they can be tolerated again.

V. Ammonia.

Ammonia is one of the most volatile of the alkalies, and has some special actions apart from its neurotic properties. Alkalies are usually fixed and pretty strong in their alkaline forms, but ammonia is very diffusible and operates with promptitude. Many cases of *headache* from acidity of the stomach have been relieved by a teaspoonful of the aromatic spirits of ammonia. It relieves this because, being an alkali, it counteracts the acidity of the stomach. It is also useful in those slight headaches caused by using tea too freely. Besides this, on account of its alkaline action when taken into the blood, it has the effect of diminishing the coagulation of fibrinous exudation. There is no doubt, therefore, that it is proper to rank ammonia among the expectorants, if by that term we mean, as we should, a remedy that facilitates expectoration. When mucus is difficult to expel on account of being viscid from excess of albuminous material, as in certain forms of *bronchitis,* inhalations of ammonia should be given. Until recently, evidence has been very strong in favor of the use of the carbonate of ammonia in the treatment of pneumonia, on account of its action as a cardiac stimulant and a liquefier. In the early stage of *pneumonia,* when vascular excitement has subsided and there is coughing, it does good in helping to raise the expectoration; but it is now considered that the danger in pneumonia is not from suffocation, but from weakness of the heart.

Ammonia is a direct stimulant of the heart, of the same kind as alcohol, increasing the rapidity and force of the beats, and dilating the arteries, causing a warm perspiration all over the body. Moreover, it is a stimulant which does not cause the slightest depression, as is the case when too much alcohol is given, because it is a pure stimulant and not a sedative. Ammonia is particularly indicated when rapid stimulation of the heart is required, as in *syncope* or *hæmorrhage.* The ammonia may be combined with brandy, this being a time-honored resource in pneumonia.

Whenever there is a severe cramp, notably in the tubular structures of the body, as in the ureters during the passage of gall stones, or in the intestines, the result is to produce cramps elsewhere. In cases of severe griping, there are cramps in the calves of the legs, as shown in choleraic diarrhœa, the patient becoming cold and the pulse small. All griping is accompanied with coldness of the extremities. A good dose of ammonia relieves this quite markedly. Similarly a stimulant dose gives great relief in those neuralgias where the patient has coldness of the surface of the body and extremities.

Ammonia is a decided diaphoretic. Five-grain doses, given every hour or two, cause the patient to perspire very freely. Some preparations are more powerful than others in this respect, but all are classed under the head of diaphoretics. The carbonate is the best cardiac stimulant. As the salts have a sharp taste, they should be given in mucilage, syrup, or licorice. The carbonate should be only given in *lobar pneumonia.* Five grains should be given every hour or two during the entire course of the disease, but care should be taken that the patient is not chilled after sweating from this treatment. Its action is still more rapid against syncope. A comparatively pleasant preparation to take is the aromatic spirits of ammonia in doses of one teaspoonful at a time, to be repeated every ten or fifteen minutes, for its expectorant action. In *broncho-pneumonia,* the chloride of ammonia should be given in doses of from ten to twenty grains every two or three hours. In certain forms of *neuralgia,* notably that of the face known as *tic douloureux,* good results have been obtained by giving thirty-grain doses of muriate of ammonia every two hours. It works better with quinine or ginger. An old German prescription, that is very successful in some cases of severe neuralgias of this kind, consists of thirty grains of the chloride of ammonia in two-thirds of a tumblerful of a strong infusion of horse radish, the whole amount to be taken in one dose.

It is claimed that the chloride of ammonia is a good *cholagogue* in jaundice. It is the favorite treatment of British surgeons in India for *chronic hepatic congestion.* Thirty grains of the muriate of ammonia are given every two hours to a patient with an enlarged and tender liver from malarial disease. It is said that after three doses have been taken the patients cry out with pain, describing it as a feeling as of the breaking of the attachments of the liver, and shortly after the liver rapidly diminishes in size and the patient recovers.

VI. Ergot (Secale Cornutum).

Ergot is a fungus, the sclerotium of Claviceps purpurea replacing the grain of Secale cereale; chemically it is a compound substance, and none of its elements have been obtained in a crystalline form. Ergot is a stimulant to the vaso-motor nerves, causing tonic contractions of the unstriped muscular fibres in the different parts of the body.

Vascular System.—Its action upon the circulatory system is almost entirely confined to the muscular coats of the arteries. In large doses, it produces tonic cramps or spasms of these fibres, and along with this, feeble heart beat and a fall of temperature all over the body, while in moderate doses it only prolongs their natural contraction. When its use is continued, it produces anæmia of the surface of the body, and especially of the brain. Dependent on this action is its use in *subacute and chronic meningitis* (cerebral and spinal). In this disease, the blood-vessels are enlarged, and there is hyperæmia of the brain. Ergot should be given until its effects are seen. The tolerance of ergot in these cases is remarkable, the dose being about ten times as large as in other conditions. It should always be administered without regard to the size of the dose. As a rule, those forms of meningeal trouble that contra-indicate strychnia are benefited by ergot, and *vice versa.* It is especially useful against the chronic dilatation of the arteries of the brain after *sunstroke.* In this condition, its action should be aided by cold douches to the nape of the neck. It is also useful in *epilepsy* following exposure to great heat and characterized by flushed face, photophobia, apprehension or fear of responsibilities, vertigo on stooping over and when exposed to the sun, bright specks before the eyes, and headache of a confused kind, attended with insomnia and slow, rapid, and irregular pulse. These are all symptoms of chronic cerebral irritation, and may be cleared up by ergot and corrosive sublimate.

Genito-Urinary Tract.—In *spermatorrhœa* due to great weakness and irritability, ergot is one of the best remedies. The fluid extract can be combined with the elixir of cinchona, two teaspoonfuls to be taken at night. Ergot is also given for the purpose of exciting *uterine contractions* when deficient in themselves, or to procure contractions of the uterus in the last stage of labor; hence the common practice is to prevent relaxation likely to occasion *post-partum* hemorrhage. A teaspoonful of the fluid extract should be given as soon as the child is born. It should not be given if the birth is likely to be delayed, because there is great danger of the child being suffocated by arrest of the placental circulation due to the action of ergot upon the uterus, producing tonic contraction without relaxation. *In chronic subinvolution* of the uterus, ergot should be used persistently. Ergot may also be used in the treatment of *tumors of the fibroid variety*. Injections into them sometimes cause them to diminish in size. It can also be used in the same way for *enlarged spleen*, viz., injections being made directly into the structure of the spleen itself.

Acne occurring in young women and aggravated at the menstrual period is sometimes relieved by ergot; but as this is very difficult to treat, and as it depends so much upon the stage of digestion and disturbance of the genital organs, particular attention should be paid to this, especially to digestion; sugars and all fats being eliminated from the diet, and the benzoate of sodium administered internally, with charcoal and salol, in small doses.

Hemicrania is not infrequently dependent on paralysis of the vaso-motor nerves of one side of the head, as indicated by throbbing of the arteries of the side affected and dilatation of the pupil, with photophobia and suffusion of one eye, and ringing in the ears. Ergot will often relieve these symptoms, if taken in full doses until no more can be borne. It may be advantageously combined with antipyrine. The ergot may be administered internally, or injected hypodermatically into the nape of the neck. It should only be given at the beginning of the attack. The dose is a drachm of the fluid extract every hour, if necessary, until three have been given.

Ergot is a great adjuvant of quinine in *brow ague* or true *periodic headaches* attended with photophobia. Quinine alone will not cure this condition. What is true of the photophobia of ague is true of all photophobias not dependent upon inflammation of the eye. Give a drachm every half-hour until relieved.

To control *hæmoptysis*, ergot should be injected hypodermatically at the nape of the neck. It is also given in *dysentery* to check the profuse hemorrhages which are apt to occur

Preparations.—Extractum Ergotæ fluidum [Squibb's] (dose, ʒ ss.–ij.); one drop is equal to one grain of the crude drug. Extractum Ergotæ (dose, gr. v.–xx.); one grain of this equals five grains of the crude drug.

VII. Strychnine.

Nux vomica is the seed of the Strychnos nux vomica, a middle-sized tree common in many parts of Hindostan, Farther India, and some of the East India islands. It is an excessively bitter powder, and owes its activity to two alkaloids, strychnine and brucine, the leading one, however, being strychnine. This is a powerful poison; its actions are peculiar and very definite. It produces death by severing the connection of the spinal cord with the cerebrum. The muscles are liberated from all control, the body is thrown into violent cramps and spasms, and death results from tonic contraction of the diaphragm and other respiratory muscles. Owing to the severity of the spasms, the muscles are frequently torn and the body is arched backwards by the contraction of the powerful muscles of the back. These symptoms resemble rather closely those of tetanus, and in some cases of poisoning by strychnine the defence is raised in courts of law that tetanus was the cause of death. The points of difference between the two are as follows: In strychnine poisoning, the symptoms develop suddenly; in tetanus, the development of symptoms is always gradual. In strychnine poisoning, the convulsions appear immediately after the absorption of the poison into the blood, the first convulsion being usually the most severe. Tetanus comes on with gradual stiffness of the muscles of the neck; after a time the muscles of the jaw become affected, and, after a period varying from several hours to two or three days, this stiffness ends in permanent lockjaw.

Except in rare cases, tetanus takes time to run its course. In tetanus, the symptoms make their first appearance in the upper extremity—the muscles of the neck and jaw. In strychnine poisoning, the symptoms are first manifested in the lower extremity, usually in the legs. They both resemble each other in this: that the slightest touch, or breath of air, or flash of light will throw the body into violent convulsions, owing to excessive reflex irritability. As soon as the convulsion is over, in strychnine poisoning, complete muscular relaxation takes place, the jaw is open, and for the time being the muscles are quite normal. In tetanus. there is never complete muscular relaxation, and the jaw cannot be opened.

Strychnine is of no use as an agent to increase the power of the voluntary muscles, and therefore in all cases of true voluntary muscular paralysis, where the region is under the control directly of the cerebrum, not of the spinal cord, strychnine should not be given. Not so in cases of paralysis of spinal origin, as in *paraplegia*. Here it is of some value, particularly in restoring the tone of mixed muscular structures rather than the purely voluntary ones—viz., all structures relating to the sphincters of the body which are mixed—for, although they belong to the unstriped muscles, every one of them is so arranged that the will has a certain power to call into play and arrest their action. In cases, therefore, of *weak bladder*, strychnine should be given, and is the main neurotic for this purpose. Where there is *incontinence of urine* from loss of the propulsive power or weakness of the sphincter, strychnine is indicated. It is the best remedy in treatment of *prolapsus of the rectum*, to which children and aged persons are extremely prone, the aged also suffering from piles or congestion of the mucous membrane about the rectum. In old people, this infirmity has an extremely depressing effect on the mind, amounting in some cases to insanity of the melancholic variety. In these cases, strychnine should be given in solution by submucous injection directly into the substance of the tissue itself, this being the most effective way to produce good results, and then retain the parts in their proper position by bandaging. This injection should be given t. i. d., if possible.

Strychnine in solution is not irritating when given hypodermatically. Care should be taken that the liquid is a good one and that the water is distilled. One-fortieth of a grain should be given to begin with, and rapidly increased until the desired effects are produced. If tolerated, it is possible to give one-tenth or even one-fifth of a grain after a time. Strychnine has a good effect in all conditions of exhaustion of the lower part of the spinal cord; therefore it is contra-indicated where there is an inflammatory condition. Aside from these actions, and in a few cases of paraplegia where it may be used cautiously, strychnine has a marked effect in increasing the peristaltic movements of the alimentary canal, and notably of the intestines, more than of the œsophagus. It may also be given in cases of water brash, a difficulty in which the patient raises a large amount of clear mucus on getting up in the morning. During the night, a large amount of mucus is secreted to keep the throat moist, and in certain conditions of the œsophagus this accumulates at the cardiac end, and in the morning is raised. Strychnine should be given. It is also specially indicated in *chronic constipation,* and on this account forms one of the ingredients in a great variety of laxative medicines. It is also indicated in conditions of *vaso-motor weakness,* where persons blush without any reason whatever, as in the case of women, particularly at the time of the menopause. Five drops of the tincture of nux vomica can be given in these cases t. i. d.

Preparations.—Extractum Nucis Vomicæ (dose, gr. $\frac{1}{4}$); Tinctura Nucis Vomicæ [℥ iv. to Oi.] (dose, ♏x.–xv.); Strychninæ Sulphas (dose, gr. $\frac{1}{40}$–$\frac{1}{20}$).

VIII. Camphor.

A stearopten or concrete volatile oil obtained from the wood of Cinnamomum camphora. It is indigenous to Eastern and Southeastern Asia, China, Japan, and the Sunda Islands. Camphor is the most diffused of all the substances of the vegetable kingdom; it is found in pennyroyal, hemp tops, and a large number of plants of this class. The eucalyptus tree seems to be destructive to *malarial poison* on account of the camphoraceous exudation from its roots, which permeates the upper layers of the surrounding soil. Camphor is a member of the carbolic-acid series of disinfectants.[1]

Locally, camphor is an anæsthetic; it can be used for *toothache*, and notably against *inflammatory pains*. In the form of camphorated oil, it is a good counter-irritant. In order to act, evaporation should be prevented by covering it with oiled silk; it should not be applied too long, as it will produce a blister.

Its stimulant action is almost entirely confined to the solar plexus of the sympathetic nervous system. It is especially useful in *choleraic diarrhœa*.[2]

In *Asiatic cholera*, camphor should be given in combination with capsicum every hour. In *cholera morbus*, teaspoonful doses of camphor water should be given every ten minutes and after vomiting; if an astringent is necessary, acetate of lead can be added to it.

In moderate doses, camphor stimulates the circulation by increasing the rapidity and force of the heart's action. It increases the secretions of the bronchial mucous membrane, and is often found in expectorant mixtures, but it has no special action in allaying the cough.

Combined with soporifics, camphor helps to induce sleep.

Preparations.—Spiritus Camphoræ [℥ ij.–Oi.] (dose, ♏ x.–ʒ i.); Aqua Camphoræ [ʒ i.–Oi.] (dose, ʒ i.–℥ ij.); Oleum Camphoræ (dose, ♏ i.–vi.).

For external use, the Linimentum Camphoræ (Camphor, one part; Olive Oil, six parts) and the Linimentum Saponis, or soap liniment, are very popular by themselves, or as the basis of more stimulating preparations.

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[1] For the uses of camphor as a disinfectant, see page 29.

[2] See under Opium, page 159.

IX. Asafœtida.

A gum resin obtained, by incision, from the living root of Ferula narthrex. It is indigenous to Central Asia, Turkestan, Western Afghanistan, and Bokhara. It grows wild in the barren regions between the sea of Aral and the Persian Gulf south to Laristan. It is found in the market in the form of irregular masses with a strong odor of garlic. Asafœtida is a neurotic which stimulates the abdominal sympathetic ganglia, and is used to correct functional disturbances only. It is a valuable medicine in *flatulency* accompanying hysteria of an emotional character, with *cold hands and feet,* with paralysis of the intestines where some parts are contracted and others dilated. It is also capable of removing many of the strange complications of hysteria.

Asafœtida can be used to relieve spasms of the genito-urinary tract, also in painful affections of the pelvic organs, as *dysmenorrhœa, amenorrhœa,* etc. It can be given for all reflex manifestations due to irritation of the pelvic viscera. *Aphonia,* coming on suddenly without any disease of the throat, is often the first symptom of *chlorosis*, or is due to some menstrual irregularity. In all these cases, asafœtida can be given with good results.

It should be given in capsules containing two to five grains of asafœtida combined with two grains of ginger and two grains of the bicarbonate of soda. It is very apt to disturb the stomach, and its action is only obtained after it has reached the small intestine. An injection of half an ounce of the tincture of asafœtida in mucilage or milk will very often cut short a hysterical convulsion.

X. Valeriana.

Valerian is a native of Europe from the Mediterranean Sea northward, and of Northern Asia, and is cultivated to some extent in Holland and England, and, in this country, in New England and New York.

Valerian resembles asafœtida in its antispasmodic action. It can be given in *hysteria* followed by low spirits. In *facial neuralgia* and *hemicrania* with photophobia, occurring in hysterical or nervous women, gr. v.–x. valerianate of ammonium, combined with gr. xxx. of the chloride of ammonium, should be given.

The valerianate of quinine does not differ therapeutically in its effects from a mere mixture of the two ingredients. The valerianate of zinc is a good antispasmodic; it should be given in pill form.

(*c*) *Those Medicines which are Sedatives only.*

On the application of cold as a remedy, there is primarily nervous depression of the nature of shock, followed by a reaction of the nerve centres impressed, so that ultimately stimulation results. On the other hand, if a person be immersed for any length of time in warm water of the temperature of 98.5° F., there is sedation, but this is not followed by any reaction, and consequently there is great exhaustion, the whole muscular system being relaxed. *Sedative neurotics* are drugs which resemble moist heat in their action, as the nerve centres which they affect are depressed and no reaction follows.

The principal sedative neurotics are the following .

1. Aconite.
2. Veratrum viride.
3. Tartar emetic.
4. Hydrocyanic acid.
5. Conium.
6. Gelsemium.
7. Anæsthetics.
8. Cocaine.
9. The Hypnotics.

I. **Aconite** (Aconitum).

Aconite is the tuberous root of the Aconitum napellus, or monkshood, an ornamental garden plant indigenous to Europe. In appearance, it closely resembles the root of horse radish, and this has led to many cases of poisoning. Its most active principle is an alkaloid called aconitia or aconitina. Aconite is a universal sedative, paralyzing particularly the nerves of common sensation. Applied externally in such manner as to reach the cutaneous nerves, it first produces tingling, and this is followed by numbness and loss of sensation. (When, in the course of pathological changes, the patient complains of tingling and numbness of the tongue and tips of fingers, it is an unfavorable symptom, indicating not only a loss of power, but that this loss is paralytic.) Hence aconite is an anodyne, relieving pain, when locally applied, by paralyzing the nerves. When taken internally in full doses, it produces the same symptoms, the patients complaining of numbness all over the body, but particularly in those parts most freely supplied with sensory nerves, viz., the tongue and fingers.

As aconite is a powerful cardiac paralyzer, there is also great depression of the heart, indicated by a slow and feeble pulse. If the dose be very large, the symptoms of suspension of the heart's action are extremely pronounced ; there is deathly prostration, and the patient is in a state of great anxiety and moans continuously; the whole body is bathed in a cold perspiration, there is frequent passing of the arms and hands, and, if death ensues, the patient not uncommonly dies in convulsions.

These are the chief actions of aconite, and from them, therefore, follow its different remedial operations as a medicine. In the first place, it is one of the most powerful reducers of temperature in *fevers* caused by inflammation. There are two entirely distinct stages in all inflammations, the *acute* and the *subacute*, and the treatment of one should be exactly opposite to that of the other.

In the first stages of acute inflammation, there is a very excited action of the heart from the irritation of the inflammation; it beats strongly and rapidly, and usually there is dilatation of the arteries leading to the inflamed part, causing a mistimed and very injurious local hyperæmia. This is followed by stasis of the capillary circulation of the inflamed area, and the blood continuing to come in a powerful stream from the arteries, the capillaries become clogged, and this increases the trouble and sets up œdema with violent pain from the stretching of the nerves of the inflamed part. The great indication in the treatment of the acute stage is to diminish arterial hyperæmia. For local inflammation, as of inflamed knee joint, the best thing to do is to apply cold, so as to cause contraction of the arteries and thus suspend the determination of blood to the part. Where cold, as in internal inflammations like *pneumonia, peritonitis*, etc., cannot safely be applied, then the old practice—and not a bad one—was to reduce the activity of the heart and of the arterial circulation by phlebotomy. If this is not done, then give arterial sedatives—medicines that reduce the action of the heart and cause less vascular excitement—and for this particular purpose aconite answers very well, as it suspends the excitement of the arterial circulation, and has a sedative action upon the heart, the very thing desired in acute inflammations. It should be commonly prescribed, therefore, in all of the acute inflammations that come within the province of the physician. Its action is illustrated particularly in the treatment of *pneumonia* in its first stages. Here digitalis, strophanthus, and nitroglycerin should not be given, because this is not the time for the administration of these remedies; rather than that, we should moderate the arterial excitement, and for this purpose aconite is very good. So also for *pleurisy* and other inflammatory conditions.

After a varying period, all these inflammations begin to enter upon the subacute stage. The treatment here is just the opposite to that in the other stage. Instead of sedatives, stimulants should now be given, for the purpose of increasing the blood current of the part to clear obstruction.[1] Aconite is not to be given in pneumonia when the patient's pulse shows that he is weak. Heart stimulants should be given instead. Nor should it be given in any inflammations when the symptoms of the acute stage are subsiding. The purposes, therefore, that aconite subserves are, to allay arterial excitement and to diminish pain; hence it may be given in *pneumonia, pleurisy*, and in the severe pains of *peritonitis*, as an adjuvant to opium to relieve the pain as well as to allay the arterial excitement. Occasionally aconite has been very beneficial in the treatment of certain forms of *neuralgia*, notably *tic douloureux*, a very chronic and difficult form to treat. In a certain proportion of cases, we can sometimes cure these neuralgias by lowering the pulse sufficiently to produce a feeling of numbness throughout the body; and this may be done by giving aconite in the form of its alkaloid, aconitia. In giving aconite regularly, watch its effects on the pulse; when it reaches fifty-five beats per minute, discontinue the use of aconite.

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[1] See pp. 189, 192.

Prescription for acute neuralgic affections:

℞ Extracti Colchici,	gr. ¼
Extracti Aconiti,	gr. ½
Pulvis Ipecacuanhæ et Opii,	gr. ij.

Repeat every three hours.

Colchicum is here given because that condition of the system which manifests itself in men by gout frequently shows itself in women by neuralgias.

Another of the properties of aconite is its specific action upon the circulation of the pharynx. When an overdose has been taken, besides the numbness and tingling of the tongue and lips there is a peculiar sensation about the throat as if it were constricted, and there is also considerable soreness. Aconite is very valuable in the treatment of *pharyngitis, tonsillitis, quinsy, abscess in tonsils,* and bad *sore throat.* For *quinsy,* first give an emetic (ipecacuanha), as this causes a profuse flow of mucus from the back of the throat, which relieves the intense congestion of the part; then give internally fifteen grains of salicylate of sodium every three hours; and, if greater certainty is desired, ten drops of the tincture of aconite root, which is double the ordinary dose—five to eight drops—may also be given. A bad *sore throat* is often benefited by giving ten drops of the tincture at night. Another of the uses of aconite is against *irritable stricture of the urethra,* where, though desirable, it is sometimes very difficult to pass a catheter. Inject into the rectum a dose of from eight to ten drops of the tincture of aconite. This has a paralyzing effect upon the rectum, sometimes causing a slight degree of prolapsus, but its action upon the contiguous organ, produced in about fifteen minutes, is very marked.

Aconite acts as a *diaphoretic* when in combination with

Dover's powder. This combination has the advantage of requiring smaller doses of Dover's powder than when the latter is given alone, and the disadvantages of the aconite are counteracted.

Aconite is also valuable as an antipyretic, as it depresses the heart's action and thus slows the arterial current. The following formula will be found useful as an antipyretic:

℞ Tincturæ Aconiti Radicis,	gtt. iij.
Tincturæ Veratri Viridis,	gtt. i.
Extracti Gelsemii fl.,	gtt. i.

M. Sig. Take at one dose.

This is also good for *chronic rheumatism* where the temperature has been above the normal for two weeks.

Preparations.—Tinctura Aconiti [Aconite Root ℥ vi., Alcohol Oi.] (dose, ♏ i.–v.); Extractum Aconiti (dose, gr. $\frac{1}{4}$–$\frac{1}{2}$). The Crystalline Alkaloid Aconitia [an extremely powerful poison] (dose, gr. $\frac{1}{200}$).

II. **Veratrum Viride** (American Hellebore).

This drug is made from the dried rhizome and rootlets of the Veratrum viride, an American herb growing in the swampy regions of the Southern and Middle States. It is more definite in its effects than the veratrum album of Europe, so that the latter is now rarely used.

Veratrum viride is a pure cardiac sedative, and it acts in a peculiar way, as it slows the force and frequency of the heart without disturbing the rhythm, which aconite does. The amount demanded to produce a definite result can be estimated by the frequency of the pulse, as it slows the heart in a very constant proportion to the quantity taken. If, for instance, five drops reduce the pulse from one hundred to eighty per minute, five drops more will bring it down to seventy, fifteen to sixty, etc. In this way, the pulse may be brought down to fifty-five per minute; below this it is not safe to go. As soon as there are any symptoms of nausea, the use of the drug should not be persisted in, as it shows that the safety limit has been reached, the nausea being due to cerebral anæmia.

The action of veratrum viride is almost exactly the action of the lancet in general blood-letting, as it causes the heart to beat more slowly and feebly, and the pulse becomes more compressible. Hence it is the medicine for a rapid and strong pulse; but where the rapidity of the pulse is occasioned by weakness, veratrum viride should not be given, and consequently it must not be indiscriminately administered in fevers. When the pulse is rapid and strong, it may be used in any disorder, as these are signs of too much excitement in the circulation, which becomes extremely dangerous if the third element of incompressibility is added, as then the patient is on the verge of the most dangerous of all convulsions These convulsions are purely epileptic in character, very severe, followed by unconsciousness, then by a return to consciousness. This will be repeated two or three times, the periods of consciousness gradually becoming shorter, until finally the patient remains in a state of coma, with one convulsion following another, until the coma ends in death.

In the convulsions of *puerperal eclampsia*, the heart starts off beating very rapidly (120 to 140). In a fever, this high pulse is not necessarily fatal, but it is so in eclampsia, for not only is the pulse both strong and rapid, but it is also incompressible. The old practice was to open a vein, and this is always indicated; but as the patient is in a dangerous condition, many physicians hesitate to do this for fear the patient's death might be ascribed by the friends to this method of treatment. If this is not done, by all means give veratrum viride, as in this disease it is exactly indicated; for, *first*, it slows the pulse by making the heart beat less quickly; *secondly*, it makes the heart beat less strongly; and *thirdly*, it opens all the arteries and makes the pulse compressible. When veratrum viride does this, the convulsions stop and the patient's life is saved. For this condition give different doses than those previously mentioned. Commence with gtt. xx., and when convulsions begin give twenty more. It may be necessary to give gtt. xx. every twenty minutes. This treatment shows the correctness of the rule that the dose of sedative medicines has not been reached until their symptoms are produced.

The symptoms of veratrum viride are slow pulse, etc., and until these are shown enough has not been given.

A similar condition exists in *acute alcoholic poisoning.* A man sometimes drinks large quantities of whiskey or brandy, and falls down in convulsions of the same kind as those previously described; the heart is excited, the pulse strong and incompressible, and the patient has a peculiar form of cyanosis, occasionally strikingly illustrated in the convulsions of children with scarlet fever. Veratrum viride should be exhibited.

Veratrum viride is sometimes given in *delirium tremens,* but it is only to be recommended in certain conditions of this disease. If there is a considerable quantity of albumin in the urine, it is not safe to give this remedy; but if the pulse is strong, and the patient's system has not been very much weakened, as the majority of these cases are very unmanageable, veratrum viride may be given to keep them quiet. It may be given in the drink for which they will be constantly asking (dose, gtt. v., repeated, if there is a strong pulse, until vomiting is induced). Under this treatment, from being very uproarious and violent they become very quiet, as there is nothing like nausea to calm excitement, this being frequently induced, by other methods, to quiet hysterical females.

Veratrum viride is also very effective in *acute rheumatism* where the patient has a rapid rise in temperature (107° to 114°), and, if he dies, with heat increasing after death. These cases have been successfully treated by the persistent immersion of the patient in cold water.[1] The immersion may have to be frequently performed before the temperature is broken, the patient often returning to the state of coma between the baths. In former days, no case recovered; but now, by giving free doses of veratrum viride in addition to the cold baths, many patients recover.

Preparations.—Tinctura Veratri Viridi (dose, ♏iij.-viij.); Extractum Veratri Viridi fluidum (dose, ♏i.-iij.).

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[1] See "Antipyretic Uses of Cold," p. 283.

III. Tartar Emetic (Antimonii et Potassii Tartras).

Taken in small doses, this substance produces nausea; in larger doses, it acts as a cardiac emetic, *i.e.*, an emetic which induces vomiting by depressing the heart's action, thus causing cerebral anæmia and general prostration of the system. It is due to this fact that tartar emetic is such an extremely powerful paralyzer of the sensory system of nerves, and to a certain extent of the motor system. It could be used as an anæsthetic, as animals under its influence exhibit no signs of pain when their limbs are amputated. Its action upon the blood when long continued is disastrous, as it produces an anæmia difficult to recover from. As an emetic this drug is not to be recommended, nor should it be used for any purpose except as a temporary expedient in the early stages of *acute bronchitis*. The beginning of this disease is frequently accompanied by intense dyspnœa, the mucous membranes of the smaller tubes being dry and tumefied. This is the period of engorgement; the patient feels as if a load was upon his chest; he is blue or dusky in the face, and has a little, squeaky cough. In this condition, the indications are to start the bronchial secretions, and for this one purpose tartar emetic acts splendidly. Add one grain of tartar emetic to a teacupful of water, and give a teaspoonful every ten minutes until the patient feels nauseated. As soon as this happens, the asthmatic condition of the bronchial tubes relaxes, the secretions pour out, and sometimes the whole disorder is aborted. Subsequently, when secretions are present, do not give tartar emetic.

IV. Hydrocyanic Acid—Prussic Acid (Acidum Hydrocyanicum Dil.).

This drug, when concentrated, is the most rapid in its action of all the liquid poisons, one drop injected into the eye of a dog killing it instantly. Many fatal accidents have happened from its use in experimental chemistry and in the process of its manufacture. Apparently it kills by the instantaneous stoppage of respiration, from its action upon the respiratory centre situated near the calamus scriptorius. It acts so suddenly that often a terrible scream is given by the patient from the air being forced out at once from the lungs, and he falls in convulsions of the same nature as those produced by sudden loss of blood. It therefore acts upon the source of the pneumogastric nerve, and consequently it is in affections of this nerve that it is to be used as a medicine. Hydrocyanic acid may therefore be added to a cough mixture to allay irritant or useless coughs, due to irritation of some one or more of the branches of the pneumogastric nerve, upon which it acts as a sedative.[1]

V. Conium.

Spotted hemlock is indigenous to the temperate countries of Asia, Europe, and North America, and has been naturalized in some portions of New England, New York, and in South America. It grows in waste places and along streams.

Conium is a paralyzing poison of the muscular system, some muscles being more affected than others; its most characteristic action being on the muscles of the eye, producing ptosis. When a person is fully under its influence, there is not only general muscular relaxation, but giddiness, difficulty of sight, and, where a poisonous dose has been taken, death from paralysis of the heart itself, if not of the muscles of respiration. It was used in ancient times in the execution of those sentenced to death, as affording one of the most painless modes of extinction of life.

This medicine has a marked value in relieving pains due to *inflammation of fibrous tissue,* as of the periosteum in *syphilis.* Here conium combined with potassium iodide and opium relieves the pain very much. In *pachymeningitis,* the addition of conium very often relieves that aching of the head so characteristic of organic mischief in the cranium. It has also been given in some forms of *epilepsy* in addition to other medicines, but only in those cases that give meningeal symptoms, notably those that occur after syphilis, blow on the head, sunstroke, etc., or where there is twitching of the muscles during sleep. Conium will promote the operation of the bromides along with chloral. It is of particular value in that class of cases where, from very early life, there is a lithæmic diathesis, the formation of stone sometimes occurring in the second or third year of life—an exceedingly dangerous condition if stone is lodged in the urethra. After this period, stone is not apt to be formed again until after thirty, but all the while there is often vesical irritation, with pain referred to the neck of the bladder, so continuous as often to undermine the health. These may be termed cases of hyperæsthesia of the neck of the bladder, a trouble which sometimes, though rarely, affects women; these persons are wonderfully relieved by conium (dose, of fluid ext. ♏ x. in ℥ i. of water, injected into rectum and allowed to remain there). It can also be used in *cystitis* where there is a great deal of pain.

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[1] See Coughs, p. 260.

Owing to the leaves rapidly losing power, ordinary preparations are very uncertain, and conium should be given in the form of Squibb's fluid extract (dose, ♏ x.–xv.). The latter will sometimes produce the symptoms of an overdose—headache, vertigo, disorder in movements of the eyes, feeling of numbness, etc.—so begin with ♏ x., and increase to xv. as the patient can bear it.

VI. Gelsemium (the root of Gelsemium sempervirens).

The yellow jessamine is indigenous to the southern United States, growing in moist woods from Virginia to Florida and Alabama, and flowering early in spring, beginning to bloom in Florida in January, and further north in March or April.

Gelsemium lessens the frequency of the pulse, but not with the same certainty as aconite and veratrum viride.

It produces vertigo with a tendency to fall forward. It can be tried in *sick headache* where the pain begins in the eyes and radiates to the back of the head, with nausea, sallow complexion, and high-colored urine; when the urine is pale in color, it does not do much good.

Preparations.—Extractum Gelsemii fluidum [Squibb's] (dose, ♏ iij.–x.).

VII. Anæsthetics.

Ether was discovered in 1846 by Dr. Morton, of Boston, previous to the discovery of the anæsthetic properties of chloroform by Sir James Simpson. Ethers produce their effects by entering the blood through the lungs; and this is almost an isolated fact, as the lungs ordinarily will not take up any medicines, as they are constructed in such a manner as not to allow the introduction into the blood of gases and vapors, with the exception of oxygen. In the case of ethers, however, and their allied class of turpentines, absorption takes place rapidly by the pulmonary air vesicles, and, when inhaled rapidly after a short period of excitement similar to that produced by alcohol, the patient becomes completely stupefied. This is a true alcoholic stimulation, and produces insensibility to pain, although the patient may be conscious that something is being done. Many details connected with its administration should be borne in mind. No anæsthetic can be regarded as perfectly safe; for it is incredible, reasoning *à priori*, that the most conservative function of the body, the sense of pain, can be interfered with without danger. All of them are dangerous, even nitrous oxide. But there is a marked difference in the manner in which these different anæsthetics produce death. In some cases, this is easily prevented; in others, with great difficulty, for reasons that we do not understand. Ethers produce anæsthesia by affecting the respiratory centre more than that of the heart, and consequently the patient may die in a state of asphyxia because he cannot, or does not, breathe. Ether is not at all likely to produce its destruction of life to the degree that chloroform does, from the fact that it gives us warning, and usually the patient can be restored by artificial respiration. efforts at resuscitation being more successful than when chloroform has been given.

It was for a long time claimed that no deaths whatever resulted from the administration of ether. This is not so; but, fortunately, the conditions, aside from suffocation, in which ether is dangerous are well determined, and are as follows. 1. In acute inflammation of the kidneys, calculus irritation, etc., because this may suddenly increase and suspend the excretion of urea, and uræmic poisoning result. 2. In general bronchitis, where there is dilatation of the right side of the heart. In emphysema with bronchitis, the administration of ether has sometimes proved fatal, not from suffocation, but from the system being poisoned with ether vapor. But disastrous results happen very rarely. In the great majority of cases, ether is as safe as an anæsthetic can be expected to be. Some deaths have resulted from operations, while under the influence of ether, in which these conditions did not exist; but as to this it can be said that deaths had taken place during operations before ever anæsthetics were used. With these few exceptions, therefore, ether can be recommended in all cases.

Chloroform, on the other hand, is extremely treacherous, and, when it produces death, does it very suddenly and by an extremely minute quantity—in one case, only one drachm, although in this case the chloroform had probably been inhaled directly.

This indicates without question that deatn is caused by cardiac, not respiratory, paralysis, though even here there is a difficulty, as sometimes the respirations cease while the heart continues to beat; but, as a rule, death results from stoppage of the heart.

A surgeon of Baltimore, from an experience of ten thousand cases in which he administered chloroform, and from experimentation on animals, claims that cases which apparently terminated fatally while under the influence of chloroform have been restored to life by *inverting* them, as he maintains that death from chloroform is due to anæmia of the brain. If this is so, of course it renders chloroform a far superior agent to ether in every respect. Chloroform is the much more convenient of the two.

The state of excitement is shorter than in the case of ether, or, in other words, it is easier to bring them into the state of anæsthesia; moreover, it passes off a great deal more quickly.

There is not the violent struggle and sense of choking as in ether, where the patient sometimes appears as if he was being strangled. On the contrary, by chloroform, in the case of children and during parturition, the patients pass at once into a gentle sleep.

Another element which shows that at all times we are dealing with something beyond our depth, is that there are certain conditions of the nervous system which make the administration of chloroform perfectly safe, in the state of parturition very few deaths resulting from its use, this state seeming to counteract the effects of chloroform upon the heart. Also, in military surgery, chloroform is a particularly successful anæsthetic, the excitement of war having the same counteracting effect. The danger in chloroform comes from giving it before pain is actually present, when the patient has not yet submitted to the operation, and probably is depressed with the thought of its approach. At first introduction, the greatest number of deaths resulted from patients in the dentist's chair. Hence there is proof that the condition of the nervous system has a great deal to do with the safety of chloroform, and when death is caused it is due to a nervous condition beyond our knowledge.

The drawback to the use of both, but especially of ether, is that they produce vomiting; many things have been tried to prevent this, but so far without success, because vomiting itself is one of the disturbed nervous functions.

It is the same with sea sickness. No remedy has yet been found for this, and it almost exactly resembles the sickness produced by the anæsthetics. There is the same deathly nausea, the same temporary relief on vomiting, followed again by intense nausea and great depression, which, as in sea-sickness, may last for many hours. Nothing will relieve it, but about the best thing to be done is to give brandy and water, and nothing more. The vomiting in ether is not only annoying to the surgeon, but is very dangerous, as, occurring while the patient is profoundly unconscious, it allows of the regurgitation of vomited matter into the trachea, in some cases this being the cause of secondary pneumonia, besides the immediate danger from suffocation; and it is particularly dangerous in operations about the head and face. The patient should be allowed no solid food for twenty-four hours before the operation, and particularly no oatmeal. He may take milk or beef tea, anything dilute that is sure of being digested. The solid food would not be digested, because, owing to the dread of the coming operation, the digestion is suspended.

In administering ether, the patient very soon begins to struggle, cough, etc., and one is tempted to let air in to relieve him, but this would only prolong the agony. The character of the respirations should be carefully noticed. The patient should be encouraged, so long as he is conscious, to inhale the ether as deeply as possible. He should be restrained so as to go through the state of excitement without injury to himself. As he gets well under the influence of the ether, he begins to snore, which is a good sign, so long as it is pharyngeal—the ordinary snoring of deep sleep, caused by relaxation of the soft palate and uvula. If instead of this it is laryngeal, stertorous, high-pitched, squeaky, croupous breathing caused by paralysis of the vocal cords, then the administration of ether should be suspended and air admitted, because now there is danger of asphyxia in two ways: First, by the ether paralyzing the vocal cords, epiglottis, etc., in which case the diaphragm ceases to act. When this happens, turn the patient over on the right side, and the breathing mechanism will resume its action.

The other danger is that, when anæsthesia is complete, the sensation of the tongue is lost and it is consequently relaxed, and if the head is thrown back the tongue is crowded into the pharynx, and asphyxia produced by stopping up the air passages. The mouth should be open, the tongue brought forward, the patient turned on the right side, and breathing will be resumed. The sign by which to judge whether the patient is fully under the influence of ether is when sensitiveness of the conjunctivæ is lost.

With chloroform, all of these statements are equally applicable about respiration, but the pulse and countenance should be carefully watched as well. The admission of air during the administration of chloroform should never be completely shut off. When, from being flushed, the face becomes suddenly pale, it is a dangerous symptom, and notably when it occurs in the mucous membrane of the lips. Irregularity of the pulse indicates cardiac weakness, and the chloroform must be suspended.

Irregular respirations of a shallow character are dangerous if repeated often, and should be treated in the same way. With these precautions, chloroform may be safely administered, especially if taken well at the beginning; there is not much fear afterwards, death most often occurring at the beginning of its administration.

Nitrous oxide is used quite extensively in dental practice and is very serviceable as an anæsthetic, provided the operation can be performed as quickly as the extraction of a tooth, the anæsthesia being very brief and so not answering for any prolonged operation.

VIII. Cocaine.

This alkaloid is obtained from the leaves of the Coca erythroxylon. This medicine has obtained a wide range of popularity within a comparatively short period of time.

Cocaine produces a localized anæsthesia when applied to the mucous membranes or the skin, and its action is decidedly marked in this respect, and extends more deeply when a hypodermatic injection is made into the submucous tissue. When painted over the skin, a sensation of warmth is at first experienced, to be followed in a few minutes by complete loss of sensation, the part becoming pale and anæmic.

Cocaine acts upon the circulation in two ways: by constricting the blood-vessels, and so increasing arterial pressure, while at the same time it stimulates the heart. The stimulating action upon the heart passes away, however, before the arterial contraction disappears.

Cocaine possesses a marked mydriatic effect. This effect is perceived in from ten to twenty minutes after dropping the solution on the conjunctiva, and it reaches the maximum effect in half an hour, lasting for another half hour, and then slowly disappearing. The employment of the muriate of cocaine as an anæsthetic in ophthalmic practice is highly spoken of. A four-per-cent solution is dropped on the conjunctiva three or four times, at intervals of five minutes, when complete anæsthesia follows.

In examinations and operations about the larynx, cocaine is employed and with good results. A twenty-per-cent solution should be used in those cases. *Tonsillitis* is sometimes relieved by the use of a four-per-cent solution of the hydrochlorate of cocaine painted over the tonsils. It may be necessary to repeat the application every hour or so. Hay fever is sometimes greatly relieved and its paroxysms prevented by painting the mucous membrane of the nose with a twenty-per-cent solution. *Epistaxis* is usually a trivial complaint, but may become dangerous when due to toxæmia and malarial diseases of the spleen and liver. In these cases, it cannot be arrested, from the fact that the veins in the turbinated bones lie in long cavities, and no pressure can be applied to them; the hæmorrhage is best controlled by applying a two-per-cent solution of cocaine. It can be used to relieve the pain of fissure in ano, when the patient suffers for several hours after a movement of the bowels. It is useful also in the treatment of hæmorrhoids and ulcers about the anus. It has been used to relieve the pains of parturition, but must be injected into the submucous tissue. Upon the genito-urinary tract cocaine acts well. The injection of a few drops of a two-per-cent solution into the urethra relieves the pain and irritation of acute *gonorrhœa*. Sometimes it is extremely difficult to pass a sound into the urethra, owing to great sensitiveness, as in the case of stricture; the injection of a few drops of the four-per-cent solution can be tried. In irritable conditions of the bladder, an injection of the four-per-cent solution is useful. In *neuralgia*, the hypodermatic injection of one-third of a grain may be employed, and the injection should be made in the course of the affected nerve.

IX. THE HYPNOTICS.

Chloral.

Chloral itself is an oily liquid discovered in 1832. The addition of water forms the hydrate, a salt with sharp taste and possessed of very peculiar sedative properties. On addition of an alkali, the salt is decomposed and gives off chloroform; hence the mistaken surmise that the action of chloral in the system was due to the chloroform elaborated from it. But the actions of chloral, and those of chloroform administered internally, are not identical; chloral having no stimulant action, as the ethers and chloroform, but is a pure sedative.

Chloral hydrate is one of the best hypnotics known, as the sleep which it causes resembles in all particulars that of nature. The patient, under its influence, drops quietly to sleep; the respirations are rhythmical, the blood is perfectly oxygenized, and it is not followed by headache and nausea from slowness of the respirations and the accumulation in the blood of carbonic acid gas. The brain is perfectly rested by the sleep, as there is not hyperæmia of the brain and a comatose state, as in the sleep by opium.

On this account, chloral hydrate is a valuable remedy in cases of insomnia, a symptom which demands close attention; for if it is allowed to go on it may lead to grave results.

It is indicated in cases of *sleeplessness* from anxiety and mental fatigue, and can, therefore, be used in mania and in patients with worn-out or anxious brain. Insomnia is one of the earliest and most persistent symptoms of insanity, and can often be traced back to care, grief, some sudden impression, as terror, or to other forms of mental shock. In this kind of insomnia, the mind is occupied with some train of thought which makes it difficult to fall asleep; and when asleep the dreams are on one subject. The brain, remaining active, has no rest and will wear itself out. As a result, there is destruction of the red blood-corpuscles, loss of bodily weight, hallucinations with a tendency to suicide, homicide, or epilepsy; and on autopsy, meningeal inflammation from excess of circulation will be found. Sleeplessness of this variety becomes dangerous when accompanied by depression of spirits, despondency, and melancholia, for these are symptoms of approaching insanity. With the depression of spirits there may be fixedness of the eye. There may be an effort on the part of the patient to throw friends off their guard by feigning cheerfulness. In this form of insomnia, chloral is the great remedy. The hypnotic must be persevered in till the patient has had five or six nights of uninterrupted artificial sleep. There will be less likelihood of the chloral habit or dependence on hypnotics when given in this way than with the usual irregular and occasional administration. After a week of artificial sleep, the patient will probably sleep naturally.

The dose is from gr. x.–xv. for producing sleep. To reduce reflex excitability producing insomnia, use it as an adjuvant to potassium bromide; add gr. viij. to each dose of the bromide in case of epilepsy. Also add small dose of the chloral in irritative coughs, as it promotes the action of medicines that allay the irritation producing cough.

So far so good. But every now and then, for reasons beyond our knowledge, chloral is fatal. When dangerous symptoms appear, it is extremely difficult to save the patient's life. The use of stimulants, electricity, etc., will rouse him out of the dangerous state, but he will relapse into it again continually. Never, on that account, begin with more than gr. x., for a number of deaths have been recorded from gr. xv., and two deaths from gr. x. doses; but usually the latter is a safe dose to begin with, and then, if symptoms are not produced, it may be increased to gr. xv. or xx., but the peculiarity of its persistent action indicates that there should be some considerable time between the doses. The dose should not be repeated under two hours' interval. Some patients can take gr. xxx. very well indeed; but do not begin with that. As an anæsthetic, its properties are not very well marked until added to other remedies.

Paraldehyd.

Paraldehyd is a medicine used only for producing sleep. It has a vile taste and is difficult to give on this account, and, moreover, it has to be given in large doses, from ♏ xxx.–xl. The taste may be covered by syrup of ginger. It is a moderate hypnotic and a good one, particularly useful in insomnia from mental causes, not so useful in insomnia due to peptic causes—fermentation in stomach and intestines. The difference between these two forms of insomnia is that in nervous insomnia the difficulty is in getting to sleep; in the other form, in remaining asleep.

Sulfonal.

This is a medicine not found in nature, but made artificially by the chemist. Chemically it belongs to the group disulphones.

Sulfonal is a whitish, crystalline substance, without odor or taste, very slightly soluble in cold water, more so in warm water, and still more in alcohol, ether, etc. It is a pure hypnotic, neither anæsthetic nor depressing in character, and it does not affect the heart or circulation, and the sleep it produces is perfect. Being quite insoluble, it requires about three hours to become thoroughly dissolved in the stomach, and should be given about two hours before bedtime. As it is not affected by the digestive secretions, it may be given shortly after the evening meal.

Sulfonal is of great value in the *insomnia of the insane*, and the dose should be repeated once during the night if the sleep is too short. It is specially recommended in cases of *nervous insomnia*, also in the *sleeplessness of delirium tremens*. In the latter case, gr. xx. should be given every two hours until sixty or eighty grains have been taken, but it should be remembered that every case of delirium tremens is also a case of starvation, and to produce good sleep the patient must be fed.

The usual dose of sulfonal as a hypnotic is gr. xv.–xx., and should be given in capsules.

Phenacetin.[1]

The number of remedial agents drawn from the carbolic-acid series seems to increase day by day. From this source we have not only obtained powerful antiseptics and active antipyretics, but more recently anodynes which, in some conditions, rival those furnished by the vegetable alkaloids. To the carbolic- and salicylic-acid classes are added antipyrine and acetanilid, and these are now increased by the addition of the phenacetins.

Phenacetin is a white, glossy, crystalline powder, being perfectly tasteless. It is freely soluble in alcohol, but only slightly so in water. It has a double action: it lowers the temperature and relieves pain. As an *anodyne*, it is superior to antipyrine and antifebrin.

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[1] Phenacetin is not a hypnotic. It is derived from the carbolic-acid series, and has actions similar to antipyrine, acetanilid, etc.—ED.

It can be used in *neuralgia, migraine, muscular rheumatism, acute articular rheumatism, and the lightning pains of locomotor ataxia.* In some cases of hysteria and of hysterical or neurotic pains, phenacetin seems to act as well as the bromides; it quiets irritable conditions of the nervous system, and in some cases induces sleep.

As an anodyne, the dose should not exceed gr. vij., and, if necessary, this dose may be repeated after three hours. The dose necessary to produce a decided reduction of the temperature in fevers is, on the average, gr. xx., and this can be divided into two parts, and each dose given in the interval of one or two hours.

For the reduction of the temperature in fevers, however, the external application of cold is to be preferred to any one of the internal antipyretics.

DIVISION II.—ELIMINATIVES OR GLANDULAR MEDICINES.

These medicines increase gland secretion, and are given more against complications occurring in the course of acute or of chronic diseases than against mere symptoms. Thus the high temperature of febrile conditions arrests secretion generally, and where this is long continued, life will be further endangered in these diseases by the complication of starvation, from the deficiency of the digestive secretions in the alimentary canal, and by the complication of self poisoning from retained excretions. If the fever be lowered and the glands supplied with blood at the normal temperature, they will at once resume their functions; but, until this is done, eliminatives are meanwhile useful, not to eliminate the disease, but to modify the complications. In those non-febrile conditions of the system where the arrest of secretions is not general, as in fevers, but local, the eliminative class of medicines is also useful, as by them the different gland secretions are sometimes made to act vicariously for some one deficient gland function, as when cathartics and diaphoretics are used in kidney disease.

The eliminatives are divided into:

1. Cathartics, which increase the secretions of the intestines.

2. Emetics, which act upon the secretions of the pharynx, stomach, liver, and duodenum in the act of emesis.

3. Diuretics, which act on the kidneys.

4, Diaphoretics, which act on the skin.

5. Expectorants, which act on the bronchial secretion.

1. *Cathartics.*

Cathartics are those remedies which increase the secretion of the intestines. The use of cathartics is indicated by two entirely different conditions: (1) in diarrhœa due to local intestinal inflammation; (2) in constipation.

Constipation.—This condition, when not dependent on some gynecological ailment, is generally due either to deficient action of the small intestine or to deficient action of some part of the large intestine.

Deficient action on the part of the small intestine is due to two causes:

1. Deficient secretion.

2. Want of innervation, or want of muscular action.

Constipation dependent upon deficient secretion is quite distinct from that caused by want of muscular action, but in many cases both causes will be operating.

Deficient secretion in the small intestine may be caused by some disturbance of the liver. Constipation, therefore, may date from the time when the patient suffered from some severe form of fever in which the liver was prominently involved, such as the bilious remittent; or it may follow an attack of tropical diarrhœa, which is almost invariably accompanied by marked hepatic disturbance.

In such cases, the patient does not have an extraordinary fecal accumulation and impaction, but there is, instead, a sluggish action of the bowels, and he is usually obliged to take medicine to bring about a movement once in four or five days; and when it does occur, the evacuation is moderate in amount and quite dry.

This kind of constipation is quite common in the Southern States as a sequence of the diarrhœa which prevails in that latitude; and it is also frequently seen in the Northern States as the result of malarial poisoning.

The symptoms are extremely negative, except the constipation. The one which perhaps gives the patient most discomfort is a tendency to a dull, indefinite headache. In a majority of cases, this is located in the posterior part of the head, is rather an uncomfortable sensation than a real pain, and is best relieved by something which promotes a free discharge of bile. The tongue usually is small, not large and flabby, generally a little reddened along the edges and tip, and the secretions of the mouth are commonly viscid. The condition of the mouth is an indication of the condition present along the entire alimentary canal. We have, therefore, evidence of the presence of only a moderate amount of secretion in the intestinal tube, and our treatment should be regulated accordingly.

If, for the relief of this condition, mild cathartics be administered, the condition of the case will be aggravated, because the temporary stimulus afforded by them, however mild, is immediately overcome by the tendency to deficient secretion. Active purgation produces a much more injurious effect than mild laxatives. If resort be had to the use of medicines which have been recommended to stimulate nerve action, not much benefit will be obtained. What should be present in the intestine is a small increase of lubricating substances, as it were, and to that end altogether the best results have been obtained by causing the patient to take a great deal more water than is his usual custom. Let him take, on rising in the morning, two tumblerfuls of drinking-water. As a rule, those who drink considerable water are not troubled with constipation. The laxative action of the water can be insured by the addition of some mild saline, like the carbonate of soda, or even common salt, and the reason why such an effect is produced is this: the mixture formed by the union of some saline with water does not readily pass through the mucous membrane, and so into the general system. The theory now generally accepted with regard to the action of salines is that they are not absorbed, and that they prevent the water with which they are combined from being absorbed; hence the water, by exciting the peristaltic action of the bowel, brings about a movement to discharge it, and with that the other contents of the intestinal tube. There is considerable to lend support to this view. It is not necessary to give large doses of saline cathartics, as a half-drachm of the sulphate of magnesia, dissolved in a pint of water, commonly operates very nicely.

There is another fact which may here be mentioned, namely, the addition of small doses of quinine to salines increases their power of acting upon the intestine. For example:

℞ Magnesii Sulphatis, ...	ʒ i.
Quininæ Sulphatis, ...	gr. i.

mixed and taken in a tumbler of water every morning, rarely fails to produce all the laxative effect required in every form of deficient secretion from the bowels; for instance, in the constipation following fever, when you desire to obtain a free alvine evacuation.

It is well to tell the patients that they will not, perhaps, see much effect for one or two weeks; but if they can be induced to persist in the daily use of large quantities of water, a great deal of benefit will almost certainly follow. There is a supposition on the part of the laity that certain fruits are laxative, and that is probably true to a limited extent. *Oranges* may be eaten with benefit, but it usually requires ten or twelve to overcome an obstinate constipation, a fact which renders the remedy quite impracticable in this climate. In the warmer climates, however, the worst forms of constipation which appear can be overcome by oranges alone; and the more juicy they are the better, from the fact that the citric acid which they contain has a tendency to produce a catarrh of the intestine if taken in excess. *Figs* are a rather dangerous laxative, for they may obstruct the intestines; there is not much danger, however, in this direction, if taken with a large quantity of water. It will be found necessary to use about double the amount of water with figs that will be required with any other laxative fruit. The fruits of this climate are very uncertain in their action; the action of apples is very good, but very many persons are unable to take them in sufficient quantity to produce any effect upon the bowels, although they may at the same time take a large quantity of water. All along it will be found that water is one of the most important agents to be employed for overcoming deficient secretion in the intestine attending constipation. If *flatulence*, resulting from decomposition of the intestinal secretion, accompanies the constipation, recourse may be had to the following pill:

℞ Asafœtidæ, ...	gr. iv.
Saponis, ...	gr. ix.
M.	

To this may be added nux vomica, if there is evidence of *deficient innervation* in the intestine.

How are we to judge that the leading element in the case is deficient innervation, especially with reference to the small intestine? As a rule, deficient innervation is an accompaniment of the constipation that troubles persons with sedentary habits of life.

As a rule, it attends the constipation present in elderly persons and such constipation also occurs among those whose occupation causes them to maintain positions in which the abdominal muscles are to a very great extent motionless, such as shoemakers, tailors, etc. There is also a tendency to headache, and there is a great deficiency in the excretion of the coloring matters of the bile, as might be expected; for the secretory action of the intestines is as much interfered with as is the muscular action. Hence this class of patients are usually of dull, sallow color; there is a tendency to greasy accumulations upon the surface; the entire movements are sluggish, and there is usually a lack of frequency in the pulse.

Now, with regard to the treatment for this class of cases, in the first place the habits of the patient have a tendency to keep up the constipation, but the means to be employed for overcoming it are quite different from those resorted to in the other class. As a rule, these patients do not bear much water, because it weakens their digestive powers, and they will very soon complain of loss of appetite, heaviness in the head, etc., and it does not excite much peristaltic action in the bowels. At all events, it is not nearly so apt to increase the peristaltic action as in the class of cases in which deficiency of secretion in the intestinal canal is the leading element.

What should be done here is to arouse the peristaltic action of the bowels, and at the same time increase the general innervation of the secretory apparatus. To do this, the best means that can be employed, if the patient is permitted to remain at his occupation, is water applied externally. The only way in which they can derive benefit from the internal use of water is to send them away from their business to a mineral spring. Then, having a change of occupation, the water taken internally will give them much benefit. But most patients will be unable to make this change, and for these water may be used externally with great advantage. Direct that a sitz bath be taken every night in water as cold as the patient can bear, and have a good reaction afterwards. In a great many cases, this simple measure will work wonders, just as it will do in certain cases of deficient innervation of the large intestine.

Another method of using water externally is, on rising in the morning, to sponge the spine and bowels with cold salt water, made about as irritant as possible. In other cases, great benefit will be derived by giving the bowels a local shower-bath, and that can be done by dashing the water against the abdomen while the patient is in the standing position. This brings about an action in the bowels, the same as a cold hand upon the abdomen causes contraction of the uterus; that is, it is through the sympathy of the nerves of the surface with the viscera underlying them. In this class of cases, nux vomica has proved itself a very efficient remedy, and it may be administered in combination with any other drug. It will increase the efficacy of small doses of the resinous cathartics, which are irritant and stimulant; hence small doses of rhubarb with nux vomica and soap may be given in the form of a pill with much more benefit than when administered separately.

The application of the faradic current, one pole of the battery placed over the spine, and the other passed up and down over the abdominal walls, will, in many cases, be found beneficial.

What is known as the health-lift will prove advantageous in certain cases, and the reason is that it brings into action all the abdominal muscles, especially the recti, and that action is brought to bear directly upon the sluggish intestines. When any lesion of the bowels is present, the health-lift cannot be employed.

In the *constipation dependent upon diabetes*, due to total deficiency of secretion into the intestinal tube, death may result in consequence of the constipation which occurs in connection with this disease.

Constipation Dependent upon Certain Conditions Present in the Large Intestine.—In the large intestine, we find that constipation depends upon nearly the same conditions as were found present in the small intestine. That is, we have constipation dependent upon deficiency of action, and that it in turn may depend upon deficient secretion or deficient innervation, but it is far more commonly dependent upon the latter. Here the patient may be troubled with large fæcal accumulations, and that condition may depend upon deficient nerve power on the part of the colon, or the deficient innervation may be confined to the rectum.

One of the worst forms of constipation may occur, dependent upon no other condition than that which is present in the rectum alone, and, unless the physician is upon the alert, the result may be the development of a rectal abscess.

When this condition is present, the patients have but little knowledge that they should have a movement from the bowels, and whenever the sensation is developed they have little or no power to expel the fæcal accumulation. When such symptoms are present, it is a pretty certain indication that they depend upon deficient innervation of the rectum, and, unless that condition is overcome, serious consequences may follow. One of the most common causes of this condition is a chronic inflammation set up about hæmorrhoids. Prolonged inflammation of any part, especially, however, about the mucous membrane, produces deficient innervation, and then follows a relaxed condition, and with this deficient innervation we are, therefore, very liable to have prolapsus of the rectum.

These patients are peculiar in one respect, namely, they are generally very low-spirited. It sometimes happens that insanity is developed by such a diseased condition of the rectum, and is relieved when the rectal trouble is removed.

With regard to treatment, the first indication is to keep the rectum empty. When fæcal accumulations are present, the most efficient and convenient method of removing them is by means of enemata; but caution must be used in resorting to this measure. Never prescribe enemata as a regular treatment, for if the patient gets into the way of emptying the bowels daily in health by enemata, he can never dispense with their use. If the patient should use the syringe every morning for the purpose of evacuating the bowels, and it is continued regularly for six weeks, he has gone considerably far towards making it a necessity during the remainder of his life. This measure should not be used unless absolutely necessary.

Within recent years, glycerin has been largely used as an enema, and in a certain proportion of cases it answers admirably; a retained injection (ʒ i – ij.) producing very free movements in from five to twenty minutes, generally unaccompanied by any pain. Glycerin suppositories are now made, and are claimed to be superior to an enema. Glycerin seems to act best when the rectum is loaded from fæcal accumulations in the descending colon. It has been used extensively in Europe for the constipation of infants (gtt. xx.). Occasionally it has produced some irritation of the rectum, but in the great majority of cases the constipation has been relieved promptly. In cases where the intestine is obstructed in adults, an enema should be tried (dose, ℥ ss) It will probably be necessary to use enemata for removing accumulations which happen to be present. but when they are thoroughly cleared out resort should at once be had to other measures for restoring lost innervation to the bowel, and one of the very best of these is the local use of strychnia It is an exceedingly valuable specific in these cases. It will frequently succeed in curing the worst forms of prolapsus of the rectum, as well as that condition in which there is simple debility with hypertrophy of the mucous membrane. The manner in which you can cure long-standing cases of prolapsus of the rectum by means of injections of strychnia into the submucous tissue itself is sometimes wonderful. If necessary, a fold of the mucous membrane can be drawn down and the injection then inserted.

This agent may be relied upon almost exclusively in the treatment of this class of cases, whether the real cause was hypertrophy of the mucous membrane from long-standing hæmorrhoids, or there was a simple deficiency of power in the rectum to expel its contents. There is another class of cases in which this agent will prove beneficial, and that is cases of prolonged cystitis from any cause. As is well known, elderly men who suffer from enlarged prostate, suffer more or less from cystitis, and they are always apt to have accumulation of fæcal matter in the lower part of the bowel, and it is for the reason to which reference has just been made, namely, deficient innervation. Hence in the treatment of any form of cystitis, especially that accompanying enlarged prostate, if the patient complains that the evacuation from the bowels is small and that the movement does not seem to completely empty them, clear them out effectually by means of enemata, and then use injections of strychnia, and you will find that, in very many cases both conditions will be materially relieved. With the other form of constipation there is a tendency to the formation of scybalous masses. The most common situation of such accumulations is at the upper part of the rectum, and next in the transverse colon. It is only when they are dislodged that they come down into the sigmoid flexure. It is in these cases that the mineral waters will be found most beneficial of anything that can be employed. In the first place, the mineral water will loosen the scybalous masses without depressing the patient in the least, and it will also prevent new accumulations. Of these, the Congress or Kissingen may be used, or both may be used at the same time. In this class of cases, considerable benefit will be derived from the use of belladonna or stramonium in the form of a suppository. The patient may take his Kissingen water in the morning, and use a suppository of belladonna or stramonium at night. If the belladonna is employed, it should be given in such quantity as will produce a little dryness of the throat and slight dilatation of the pupil the following morning.

Faradization along the track of the colon is equally beneficial as in the treatment of constipation of the small intestine; and the hip bath may also be of service, but it does not answer so good a purpose as when the small intestine is chiefly involved. If possible, the use of enemata should be avoided except for the purpose of removing fæcal accumulation near the anus, for the effect produced by much overdistention of the intestine is bad. A single overdistention of the bladder may be followed by a permanent weakness for the remainder of the patient's life, and that distention may not last more than eighteen hours. So a single overdistention of the intestine may greatly weaken the normal rhythm of that tube.

Constipation and Fæcal Accumulations following Febrile Diseases.—The effect of fever is to dry up all the secretions present in the intestine; consequently a very common complication when a patient is making a recovery from pneumonia or any other disease in which fever has been a leading element, is an accumulation of fæces at different parts of the intestinal tube.

In former days, when fevers were treated upon the plan of administering medicines which were to eliminate the poison from the system by way of the bowels, scybalous accumulation did not occur very frequently; but nowadays, when the treatment is conducted upon an entirely different plan, the fever may be continued and retained as the direct result of fæcal accumulation. This is especially true of the latter stages of a fever; but such accumulation can be prevented from forming, and be removed by the use of a proper kind of cathartic. For this purpose there is no combination more serviceable than the compound jalap powder, and it is the one which by all means should be employed. It promotes the discharge of the serous elements into the intestine, assists in the absorption of the deposits which have taken place in the lung, if the case be one of pneumonia, acts upon the kidneys as well as upon the bowels, and is one of the mildest cathartics that can be employed, which so fully meets the indications in this class of cases.

Constipation Due to Great Deficiency of Biliary Secretions.—In this form of constipation, there are sallowness and greasiness of the skin. Compound Licorice Powder, formed of Senna, 18 parts; Licorice, 16 parts; Fennel Seeds, 8 parts; Washed Sulphur, 8 parts; Refined Sugar, 50 parts, should be given as a laxative (dose ʒ i.-ij.). This powder is also very beneficial where there is irritation of the rectum, and should be the laxative wherever there is a tendency to *hæmorrhoids*.

Nervous Constipation of Women.—In the female sex, constipation is sometimes due to suppression of the peristaltic movements of the intestine by reflex *irritation* of the *ovarian plexus*, which will also cause cold feet, the irritation contracting the arteries of the legs, and there will be aching in the back. Warming the feet artificially, and giving belladonna, with a small dose of extract of colocynth,[1] will often relieve the whole trouble.

In administering cathartics, the following facts are to be remembered:

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[1] For prescription, see page 181.

1st. All cathartics operate better when in combination with each other, or with some other medicine, than when given alone. By combining small doses of several cathartics, the particular action of each can be secured without the undesirable qualities of any, and this combination is therefore practically a new medicine.

2d. Quinine and the mydriatics assist them in their action; quinine especially increasing the power of the sulphate of magnesium.

3d. All saline cathartics must be taken very cold or very hot, as their action depends on their affecting the stomach.

Cathartics may be divided into the following classes:

(*a*) Cathartics which stimulate natural secretions.
(*b*) Irritant or drastic cathartics.
(*c*) Saline cathartics.

(*a*) CATHARTICS THAT INCREASE THE NATURAL SECRETIONS.

Calomel.

Calomel is *the* cathartic for *fevers* when the constipation is due to the arrest of the normal secretions by the high temperature, so that the stomach is wholly unable to digest solid food from the absence of the digestive secretions, and there is the serious danger, in all fevers lasting more than fourteen days, of the patient being virtually starved. A dry skin and intense thirst are present, and, owing to the scanty flow of urine, materials which ought to be excreted are retained, and there is the further danger of self-poisoning. Calomel, therefore, should be given as a cathartic at the commencement of every *fever*, as it stimulates in a natural way the secretions of the intestines, and thus diminishes the danger of starvation; and, being also a diuretic, it increases the flow of urine and diminishes the danger of self-poisoning from retained excretions. In addition to this, it will be found that in every fever, after the calomel has operated, the temperature is lowered, the skin becomes moist, and the intense thirst which invariably accompanies a dry skin is relieved. It has been demonstrated that *typhoid fever* runs a much better course if a calomel purge is given at its commencement. It is supposed that the retained excretions early vitiate the blood and afford a fruitful soil for the reproduction of the morbific germs of the disease.

Calomel as a cathartic should always be given in large doses, as the effect does not vary much with the dose. When given alone, it acts in about twelve hours, but its action is hastened when combined with other cathartics, especially jalap and cream of tartar. Calomel is also valuable as a cathartic where the secretion of bile is deficient from congestion of the liver or other *functional* causes. A good formula for biliousness is:

℞ Pil. Hydrargyri, ...	gr. iv.
Sodii Bicarbonatis,	
Pulv. Rhei, ...	āā gr. viij.
Pulv. Aloes, ...	gr. ij.
Quininæ Sulphatis, ...	gr. iij.

M. Fiant capsul. No. iii. Sig. Take at one dose.

In cases of *lumbago* and other forms of muscular rheumatism, with acid urine of high specific gravity, a cathartic of blue pill (gr. v.) with ipecac and soda is the best mode of treatment. *Scrofulous* children are often troubled with loss or perversion of the appetite, associated with constipation, with light or clay-colored stools, showing a deficiency of bile. These cases are greatly benefited by the use of some mild mercurial cathartic, as two or three grains of the hydrargyrum cum creta, combined with rhubarb and soda. This should be given three times a week for two or three weeks.

Castor Oil (Oleum Ricini).

This oil is expressed from the seeds of the Ricinus communis, a plant the best varieties of which grow in warm climates free from frost. The "cold drawn" castor oil is to be preferred, as this method of preparation eliminates an acrid principle, very irritating and poisonous, contained in the outer coat of the seed. The effect of oils in general, when applied to mucous membranes, is to produce a non-albuminous, watery flow until every particle of the oil has been washed away; and it is probably due to this action, and to its stimulation of the peristaltic movements of the intestines, that castor oil owes its cathartic properties. It has not, however, a local action upon the intestines alone, for, after it has been absorbed into the blood, it produces the same effects elsewhere. This has its advantages and disadvantages, for castor oil given to a nursing woman will sometimes purge the infant, but at the same time it stimulates the secretion of milk. (A fomentation of the leaves of the plant, or castor oil itself, applied to the breast, is often used for this purpose.) Castor oil, therefore, should not be given where these effects are not desired, nor should it be given to children with *capillary bronchitis;* for, acting upon the same principle, it stimulates the secretion of mucus in the bronchial tubes—the very thing to be avoided, as, owing to the feeble expectorant powers of children, this disease is very dangerous, and one of the commonest causes of death among them. (These cases may often be successfully treated by giving ʒ ss. doses of hot milk and lime water, which strengthens the heart and assists expectoration by taking advantage of the vaso-motor nervous association existing between the œsophagus on the one hand and the trachea and bronchial tubes on the other.)

Castor oil is a very good cathartic for the fæcal accumulations, or constipation with dry, hard fæces, occurring in many *febrile diseases* of short duration. Where the fever is prolonged, calomel is the best cathartic; but where, as in malarial fever, it lasts only for a day or two, castor oil, besides its beneficial cathartic action, is also effective in rapidly lowering the temperature.

It is *the* remedy to begin with in the treatment of the *dysentery* of temperate climates,[1] a disorder not uncommonly due to the retention of hard fæcal matter. After the bowels have been cleared, the treatment should be castor oil ʒ i., and laudanum gtt. x., given every three hours. This combination has a beneficial soporific effect not produced by the laudanum given alone. Castor oil is indicated in all cases where there are stringy mucus, blood, etc., in the fæces. As a rule, it is a prompt cathartic, producing movements within half an hour after administration; but in some cases they will not take place for four hours, or even longer (dose, ℥ ss.–i.).

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[1] For the treatment of the dysenteries prevalent in hot climates, see page 247.

Aloes and Rhubarb.

These are excitants of the natural secretions, *par excellence*, and the only ones to be recommended for this purpose. Therefore, in all cases where, from absence of the digestive secretions, there is *intestinal catarrh* or imperfect action of the liver, with sallowness of skin, loss of appetite, and sluggish, irregular action of the bowels, or mal-digestion with consequent disorders, the first and foremost of which is *summer diarrhœa*, these cathartics are the ones indicated, as they restore the digestive powers, improve the appetite, etc., and may be given for months together without any harmful results; whereas other cathartics, if their use was so long continued, would certainly cause a great deal of weakness if not serious intestinal derangement. Many of the symptoms of *chronic dysentery* will also be relieved by the daily administration, week after week, of rhubarb or aloes.

Aloes.—This substance is the inspissated juice of the leaves of the Aloe Socotrina and other species of aloes growing in warm climates. The best varieties come from Mozambique. It is a greenish-black substance, breaks with a smooth, glassy fracture, and has an aromatic odor. It contains a crystalline principle called aloin (dose, gr. $\frac{1}{10}$–i.). Aloes is a slow cathartic, requiring from twelve to eighteen hours before it operates, and, if given alone, causes considerable griping. Hence it is often necessary to combine it with other cathartics, and it acts best when in combination with rhubarb in the compound rhubarb pill (Pulv. Rhei, gr. ij.; Pulv. Aloe, gr. iss.; dose, two to five pills). The movement produced by it is not watery, showing that it relieves the system of fæcal accumulations. Many ailments, especially those of young women, are due to such accumulations, the patients sometimes not having a movement for several days. For this condition, and for *offensive breath* dependent on intestinal disorders, aloes and rhubarb in the form of pills, with the administration of nitro-muriatic acid, is the most successful treatment. An old prescription, and a very good one, for stimulating the sluggish digestion of *chlorotic* women, was tincture of aloes and myrrh. (This mixture is intensely bitter, and is now put up in pill form.) Given with iron in *chlorosis*, this mixture answers admirably, as it improves the appetite, overcomes the constipation, and promotes the assimilation of the iron. Aloes also stimulates the circulation of the pelvic viscera, and acts upon the uterus as an emmenagogue. It is, therefore, indicated in *amenorrhœa, dysmenorrhœa*, also in *chronic constipation*, in *piles* which are not inflamed, in *prolapsus of the rectum* not due to recent inflammation, and in *enlarged prostate* from sluggish circulation. It is contra-indicated when inflamed *hæmorrhoids* are present; also in *pregnancy, cystitis*, and in inflammatory conditions of the pelvic organs.

The dose of the powdered aloes is ten grains, but if given twice a day, five grains. As it accumulates in the system, the doses should be smaller still if its use is to be continued for any length of time. A saline drink should be given six hours after its administration, or in the morning when the aloes is given at night on retiring.

Rhubarb (Rheum).—This resinous cathartic is prepared from the root of several species of Rheum growing in elevated regions of Central Asia. By virtue of a kind of tannic acid contained in the root, rhubarb possesses astringent as well as purgative properties. Rhubarb, as a cathartic, stimulates the intestinal movements and produces a slow, griping movement in from six to eight hours. This is followed by increased appetite and a tendency to constipation, the tannic acid operating after the cathartic action has ceased. Combined with an alkali, rhubarb makes a sort of emulsion which, in its constituents and properties, closely resembles human bile, less some of its salts. Besides its other properties, it is, therefore, both antiseptic and restorative. Hence rhubarb is the typical cathartic for the common *summer diarrhœa* due to intestinal fermentation, especially when it occurs in children. For the purpose of preventing the griping action of both rhubarb and aloes, we combine other substances with them. The alkalies are the best for this purpose, as they do not cause constipation and promote the action of the cathartics. The bicarbonate of soda and magnesium sulphate are the substances generally used. *Soap* has the same effect as the alkalies, but not to the same degree. All spices will counteract griping, but they cause constipation. As, however, we want this effect in treating diarrhœa, the aromatic tincture of rhubarb is commonly prescribed for this disorder.

For the treatment of *summer diarrhœa* of adults, the following is a good prescription:

℞ Magnesii Sulphatis,	ʒ iv.
Tr. Rhei,	ʒ vi.
Syr. Zingiberis,	℥ iss.
Aquæ Menthæ Piperitæ,	ad ℥ vi.

M. Sig. Tablespoonful every three hours.

For a child one year old or under:

℞ Tr. Rhei,	ʒ ij.
Magnesii Sulphatis,	ʒ i.
Syr. Zingiberis,	ʒ iv.
Aquæ Menthæ Piperitæ,	ad ℥ iss.

M. Sig. Teaspoonful every two or three hours until the diarrhœa is stopped.

Opium should not be used, as it aggravates the original cause by suspending the natural secretions, but it may be necessary to give it where there is inflammation, and in violent peristaltic movements it may be necessary to use it.

Cascara Sagrada.

This drug is the dried bark of the Rhamnus Purshiana, a tree growing on the North Pacific coast. A very bitter fluid extract is made from it. In small doses it acts as a tonic, improving the appetite, etc.; in larger doses it is a mild cathartic. For *offensive breath* caused by intestinal disorders, this substance is an excellent remedy if the patient is not troubled with *hæmorrhoids.* Give five drops of the fluid extract three times a day, as it operates better in this way than if given in one dose.

(*b*) Irritant Cathartics, or Drastics.

The drugs which form this class are all vegetable cathartics, and contain resinous and acrid principles in such a degree that in large doses they produce severe if not fatal gastric irritation and inflammation. Their operation is accompanied by more griping than that of other cathartics, and the violent purgation often produces faintness; but where prompt and free action is desired, recourse must be had to them. If small doses of several of these cathartics are combined, it prevents the too great activity of any one of them acting singly.

Colocynth

Is the dried pulp of the Citrullus colocynthis, a bitter cucumber growing on the southern and eastern shores of the Mediterranean Sea. When fully developed, it is a gourd about the size of a large orange. The part used in medicine is the pulp surrounding the seeds, and is intensely bitter and irritating to the eyes. It contains an active principle called colocynthin.

When given alone, even in small doses, it produces intense inflammation of the duodenum and of the biliary and pancreatic ducts, with a profuse flow of serum. Its action may be so violent as to produce fatal *gastro-enteritis.* It is never used alone, but as an addition to the laxatives where it is desired to unload the bowels or to deplete the portal circulation. It should never be used where there is dropsical effusion.

It is an active constituent of Brandreth's pills, and the chief ingredient of most quack pills. The administration of three of the compound cathartic pills of the U. S. Pharmacopœia (which contain colocynth) is an excellent preparatory step to the exhibition of quinine in malaria. For *chronic constipation of women,* this drug, with belladonna, etc., is superior to calomel.

Scammony.

This substance is the resinous exudation from the root of the Convolvulus Scammonia, a vine growing in Arabia and Syria. It is an extremely powerful cathartic, resembling colocynth in its physiological action. It is generally used in combination with other drugs.

Jalap.

Jalap is the tuberous root of the Exogonium purga, and is named from the town of Xalapa, in Mexico, of which country the plant is indigenous. It is the mildest in its action and the least irritating of all the resinous vegetable cathartics, producing a prompt watery flow from the small intestines. On this account it is especially useful for unloading the portal circulation. A very good combination for this purpose is jalap ten grains, and calomel ten grains, as each drug assists the action of the other, and there is no nausea. Its action may be made still more beneficial by adding about sixty grains of bitartrate of potassium. Jalap is the cathartic to be used when the blood is charged with poisonous substances, as in *Bright's disease.* It may also be given to remove the *ascites* and *dropsy* of this disease, especially when the dropsical effusion begins to threaten the lungs; and to relieve the *cerebral congestion* which is sometimes an accompaniment of certain forms of this disease. In those cases of *congestive bronchitis* where the patients have a short cough, great hyperæmia in the chest without much secretion, shortness of breath, etc., and which may go on to dangerous suffocative bronchitis, a prompt cathartic will often cut short the attack, and, as one is indicated which produces a watery flow, jalap should be given. Purgative dose of jalap is ℈i.–ʒi., combined, if desired, with a small dose of calomel. The compound powder of jalap (*Pulvis jalapæ compositus*) is formed of jalap thirty-five parts, bitartrate of potassium sixty-five parts.

Podophyllum

Is the outer root of the Podophyllum peltatum, or may-apple of North America, growing in the Northern and Middle States, and is best when obtained just after frost has set in. In its action it is as irritating and acrid as colocynth, producing bloody vomiting and discharges, with inflammation of the intestines. It is the most certain cholagogue of all the vegetable cathartics, but its action is very slow, and, unless combined with other drugs, cannot be hurried. On account of its action upon the liver, it is of considerable use as a cathartic in cases where constipated patients have been *malarious*. It should be combined with a small dose of compound extract of colocynth. The dose of the resin, which is the only trustworthy preparation, varies from one-sixth to one-half of a grain.

Elaterium.

A substance deposited by the juice of the fruit of Momordica Elaterium, a small trailing vine growing on the shores of the Mediterranean Sea. It is very uncertain in its strength, and on this account has been omitted from the official list, and its active constituent, **Elaterin**, substituted. The latter consists of small, colorless shining scales or prisms, without odor, which are not altered on exposure to the air, and have a somewhat acrid and extremely bitter taste.

When given in full therapeutic doses, it produces a copious serous discharge, which may contain albumin and even blood, with great prostration of the nervous system which may be fatal. Elaterin operates by paralyzing the solar plexus, and, when given in toxic doses, its symptoms resemble those of cholera. It is the most efficient of this class of medicines in producing absorption of dropsical effusions in renal disease. It has been claimed that it has the power of causing the elimination of urea by vicarious action of the bowels. It should always be combined with other cathartics (dose, gr. $\frac{1}{20}$–$\frac{1}{16}$).

Camboge (Cambogia).

A gum resin obtained from the root of the Garcinia Hanburii, an East Indian tree. As a cathartic it produces a copious watery flow, but, owing to the violence of its action, it is not to be used in *chronic constipation* except of the most obstinate kind, as it leaves the bowels in a state of torpor, due to the reaction of overstimulation and secretion. Dose is from two to five grains with soap, but it is seldom given alone.

Senna.

The leaflets of several species of Cassia growing in Central Asia, India, etc. It is usually administered in the form of an infusion which has a very bitter and nauseous taste. This infusion combined with epsom salts and an aromatic makes the noted "black draught." Senna operates very beneficially in cases of *intestinal atony* following *malarial* disease, and where constipation is accompanied with biliousness. It is now put up in many elegant forms, which must be used interchangeably. It is also combined with sulphate of magnesium in capsules.

Compound Cathartic Pills (U. S.)

These pills have long been noted for the relief of portal congestion, and should always precede the administration of quinine. Each pill contains the following ingredients: Calomel, gr. i.; Abstract Jalap, gr. i.; Ext. Colocynth. Comp., gr. 1⅓; Camboge, gr. ¼. The full dose is three pills.

Croton Oil (Oleum Tiglii).

This is a fixed oil obtained from the seed of the Croton Tiglium, a plant growing in the southern part of Asia. It is violently irritating both to the skin and gastro-intestinal tract, producing to the greatest degree the catarrhal effects of oil. It mixes readily with any other oil, and one part croton oil to nine parts sweet almond oil is very effective as a counter-irritant in *catarrhal bronchitis*, *congestive bronchitis*, and in certain stages of *phthisis*, as, applied to the chest, it gives rise to a very extensive eruption. The strength will have to be increased as the skin becomes habituated to its use, until finally the pure oil itself may have to be applied, which then produces no greater effect than its original application of one part in ten. In the *spinal irritation* occurring most frequently in women and young girls, partly nervous, but mainly dependent on weak muscular power-where there are several tender places along the spine, especially over the sacrum, counter-irritation works very well, and croton oil may be applied in the manner above described.

Given internally, croton oil is an intense hydragogue cathartic, acting more powerfully than any other, and producing profuse discharges with griping pain. It should be used when a speedy and complete evacuation of the bowels and a diminution of the arterial pressure are demanded; and the smallness of the dose (gtt. i.–ij.), and the fact that it acts if simply placed on the tongue, indicate that it is to be used in those cases where consciousness or deglutition is suspended and a cathartic is needed. It is, therefore, to be given in *coma*, especially if it be apoplectic, but not if the patient is in a state of *syncope;* in other words, if the pulse is full and strong, give a cathartic to prevent further cerebral inflammation; if weak and irregular, do not give it.

Croton oil is also to be recommended as a purgative in the early treatment of *cerebro-spinal meningitis* when the symptoms are high fever, stiffness of the muscles of the neck, etc. It should also be used to remove an impaction of fæces in the intestines when other remedies fail.

(*c*) SALINE CATHARTICS. [1]

This class of purgatives have a peculiar mechanical action, which depends on their saline properties. They are extremely difficult of absorption, but remain in the intestines, and by their presence act on the mucous membrane, causing an increase of secretion. But this is only a part of their action. As the natural secretions are poured out, this class of purgatives, through their affinity for water, prevent their reabsorption, and thus increase the liquid part of the fæces. Their action is analogous to that of an enema. As they do not increase the secretion of the intestinal juices, they are not followed by constipation. These are true *hydragogues,* as they produce a flow of water. They act rapidly, producing little or no griping, and are not followed by prostration. They are very useful where the dejecta are scanty in quantity and dry, as in the case of drunkards; also to remove accumulated fæces and irritating matters from the intestines, *except* when they have produced inflammation. Their prolonged use is to be avoided, for by preventing reabsorption of the intestinal juices they impoverish the blood. On account of their refrigerant action, they should not be given in *chlorosis, jaundice, Bright's,* or any exhausting or depressing disease. Their effect is increased by adding small doses of quinine. When given in small doses (one-eighth of a purgative dose), they act as *diuretics*. The saline cathartics are contraindicated in fevers and when iron is administered, as they prevent its absorption.

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[1] See also Mineral Waters, p. 101.

Sulphate of Magnesium (Epsom Salts).

This is an intensely bitter, crystalline salt, causing free watery discharges. It seems to act especially on the mucous membrane of the duodenum. Its cathartic action is increased by dilution with water, and it appears to be more active when dissolved in hot water. The addition of quinine also increases its power of acting upon the intestine, a grain of quinine to a drachm of sulphate of magnesium in a tumbler of water rarely failing to produce all the laxative effect required. Sulphate of magnesium causes less depression than any of the other saline cathartics, but if given too often it produces intestinal debility and a tendency to *anœmia*. Combined with senna and an aromatic, it forms the well-known "black draught" (dose of Sulphate of Magnesium: laxative, ʒ i.; purgative, ℥ ss.).

Sulphate of Sodium (Glauber's Salts).

In some respects, this salt is superior to the sulphate of magnesium, but, on account of its extreme bitterness, it is rarely taken, except in the mineral waters of Friedrichshall, Carlsbad, etc. (see Mineral Waters, p. 102).

Cream Tartar (Potassii Bitartras).

This salt has a pleasant, acid flavor, and is well borne by the stomach. Given in doses of half an ounce, it will act as a hydragogue cathartic without any griping or other bad symptoms. In sixty-grain doses, it operates as a diuretic, and is to be given in fevers when the secretion of urine is deficient. Combined with lemonade, it makes a cooling drink, and its diuretic properties may be increased, if desired, by adding some other diuretic. It is especially useful in the hot stage of *chills and fever*, in all *eruptive fevers*, and for children in *scarlet fever*.

Tartrate of Potassium and Sodium (Rochelle Salts).

This is the most palatable of any of the salts, and it acts without griping. When given just short of the purgative dose, it acts as a diuretic and increases the alkalinity of the blood.

Phosphate of Sodium (Sodii Phosphas).

This operates as a mild cathartic, and is very useful for children, since, tasting like common salt, it may be put in milk or gruel (dose, ℥ ss.). Being an antacid, it is a good prophylactic for some of the attendant troubles of *rheumatism*—skin disease, bronchitis, slight rheumatic pains, etc.—and may also be given in cases of malnutrition that occur in rheumatic families with scrofulous tendency. In acute articular rheumatism, the blood should be made alkaline as soon as possible, and more powerful drugs than phosphate of sodium are required for this purpose. As this salt is a constituent of the blood, poisoning need not be feared.

2. *Emetics.*

Emetics are drugs given for the purpose of producing vomiting. They are unpopular medicines, cathartics generally taking their place, but in certain conditions they do a great deal of good. Thus an emetic given at the very commencement of an attack of *tonsillitis* will very often abort the disease at once, as it causes a free flow of mucus from the pharynx, which acts as a local depletive. Emetics are of two kinds: (*a*) cardiac, (*b*) irritant.

(*a*) CARDIAC EMETICS.

Cardiac emetics produce nausea and vomiting by their action upon the heart, reducing its action, and causing in this manner anæmia of the brain and great prostration to the system, similar to that caused by extreme loss of blood with its accompanying deathly sickness. It is upon this action only that their emetic properties depend. The medicines which act as cardiac emetics are neurotics. They produce intense nausea, and the vomiting is persistent and often uncontrollable. Those belonging to this class are digitalis, colchicum, tartar emetic, lobelia, tobacco, etc. They are not medicinal emetics, but the emesis is due to their poisonous effects.

Apomorphine[1] (Apomorphinæ Hydrochloras).

This is the hydrochlorate of an alkaloid obtained by heating morphine or codeine in sealed tubes with hydrochloric acid. It forms in small, grayish-white, shining needles, which are inodorous, faintly acid, and turn green on exposure to light and air. It is much used in Europe to produce emesis, but it produces great depression of the system, and on this account is not to be recommended. It may be given in cases where, for any reason, ordinary emetics cannot be administered, as in cases of narcotism where the patient is unable to swallow (dose, gr. $\frac{1}{6}$ by the mouth, gr. $\frac{1}{8}$–$\frac{1}{4}$ hypodermatically). Patients usually vomit three times before the action of the drug ceases.

Irritant or medicinal emetics owe their properties to their irritative effects, producing vomiting by reflex action. Thus emesis of this kind may be produced by tickling the back of the tongue with a feather or with the finger, or by drinking warm water containing a certain proportion of mustard or salt, the irritant properties of the mixture causing a decrease in the secretion of the digestive juices, and vomiting. The vomiting produced by irritant emetics is free from nausea, and there is no depression of the system. They also act more quickly than the cardiac emetics, and so are to be given in all cases where rapidly induced vomiting is desired.

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[1] The other emetics of this class are treated of elsewhere, as, owing to the great depression following their administration, their use as emetics is not to be recommended.

Contra-indications to the use of emetics: (1) No person over the age of fifty years should ever take emetics, as the act of vomiting produces great cerebral congestion, and the act itself increases in difficulty after the fortieth year has been passed. (2) Where poison has been taken. Here the stomach pump or stomach siphon should be used to empty the stomach. (3) Emaciation. Owing to the stomach getting well up behind the ribs, many thin persons cannot vomit, or can do so only with great difficulty. This, to some extent, may be obviated by giving the patients liquids to distend the stomach and bring it in contact with the abdominal walls. (4) Obesity. Here there is difficulty in vomiting on account of the muscular weakness of the abdominal walls.

(*b*) IRRITANT EMETICS.

Ipecacuanha.

Ipecacuanha is the root of a Brazilian shrub, Cephaëlis Ipecacuanha. It contains an active alkaloidal principle called emetine. Locally applied, ipecacuanha acts as a direct irritant, causing a peculiar eruption which lasts from five to six days. In this way it can be used as a counter-irritant—for example, in *tuberculosis* of the lungs—to raise sores on the surface of the chest. Tartar emetic was formerly used for this purpose, but the sores produced by this substance left scars, while those produced by ipecacuanha do not. (Mix gr. x.-xv. ipecac. in ℥ ss. of lard.) As a general emetic there is nothing to be compared with ipecacuanha. It is not a cardiac emetic, and therefore not prostrating to the system. When taken into the stomach, it causes, by its irritant action, a considerable flow of mucus, and, in the vomiting which ensues, the contents not only of the stomach but also of the duodenum are expelled, and the liver, by the mechanical action of the abdominal muscles, is stimulated in its circulation. Emesis, therefore, clears up a *jaundiced* countenance more quickly than anything else, the bile pouring out rapidly under the influence of the drug. In many cases, therefore, of *hepatic congestion,* and notably at the beginning of *fevers,* emesis gives great relief by reducing the fever and irritation. Children under two years of age naturally possess weak expectorant power, and when suffering from diseases such as *acute capillary bronchitis, pneumonia, croup,* etc., are often in an extremely perilous condition from their inability to raise the matter to be expectorated higher than the larynx. To aid expectoration, emesis may here be induced several times during the day and night at intervals of four or five hours. Prostration need not be feared, as vomiting does not have the same effect upon children as upon adults, regurgitation occurring very easily in the former. The emetic should be given as soon as the respiration increases in frequency and the breathing becomes labored from accumulation of mucus in the trachea. Emesis should always be used for the reflex laryngeal spasm in coughing which occurs in *croup,* and for the spasmodic cough in *false croup.*

In the dangerous *dysenteries* of tropical climates, ipecacuanha is much used on account of its specific topical action in the large intestine. A sinapism or blister is placed upon the epigastrium, and as soon as this has acted gr. xxx. of ipecacuanha should be given as a dose with gtt. xxv. laudanum, and the dose repeated every hour until gr. xc. have been taken. The first dose may induce vomiting, but not the second or third. The effect is to change the whole dysenteric process. For the milder dysenteries of this country, castor oil is to be preferred.[1]

Where there is a tendency to *tonsillitis,* a disease which often precedes an attack of acute articular rheumatism, on the first manifestation of sore throat give ipecacuanha, which, acting as a local depletive, often aborts the disease, and apply iodine or bromine to the tonsils once or twice a day, as in the following:

℞ Tincturæ Iodi, ... ʒ iv.
Tincturæ Aconiti, ... ♏ xx.

M. S. For local application.

This should be diluted on the second day with tinctura cinchonæ comp.

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[1] See also p. 234.

Sulphate of Zinc.

This is an irritant emetic, has good topical operation, produces no prostration, and hence may be used as an adjuvant to ipecacuanha, the combination acting better than either emetic by itself (dose, Ipecac., gr. xx.; Sulph. of Zinc, gr. xv., for adults; for children proportionately less). To produce emesis, sulphate of zinc should not be given in small doses. Many patients, dreading the nausea of an emetic, take small doses, thinking that the smaller the dose the less there will be of sickness and nausea; but just the opposite actually occurs. A dose of gr. xx., therefore, is better than a dose of gr. xv., and still better than one of gr. x., which produces nausea but no vomiting (dose to child, gr. v.). This emetic operates in about ten minutes. It should not be given unless it is certain that the patient will vomit.

Sulphate of Copper.

This drug, like all strong astringents, is also an emetic, producing emesis without any prostration of the system. It is much used by German physicians in the treatment of *croup*. It may be used in the early stages of this disease when there is considerable bronchitis, and before the period of excitement is followed by carbonic-acid poisoning. But when the latter stage has been reached, no emetics of any kind should be given, as the susceptibility of the stomach to these remedies is blunted by the carbonic-acid poisoning. As emetics soon become tolerated by the system, it is well to use them interchangeably. Commence with ipecacuanha, and, after three doses have been given, change to cupric or zinc sulphate. Sulphate of copper is far more irritating than the other emetics, and should not be repeated more than twice (dose as emetic: children, gr. i.–ij.; adults, gr. iij.–v.).

3. *Diuretics.*

Diuretics are remedies which have the property of increasing the volume of urine excreted from the kidneys, either by increasing the general blood pressure, or by causing local dilatation of the renal arterioles, or by direct irritation of the renal structure. When given for the relief of symptoms not dependent on any renal disease, diuretics are said to act *generally;* when given for the relief of symptoms dependent on some derangement of the kidneys or genito-urinary tract, they are said to act *locally*. The following conditions of the urine are to be taken as indications for the administration of diuretics: (1) *Urine of high specific gravity but of normal quantity.* Saline diuretics are to be given, and, as this condition is indicative of high living and gouty diathesis, the diet is to be regulated and the use of alcohol and other stimulants prohibited. (2) *Urine of high specific gravity but deficient in quantity.* This, if not due to excessive perspiration, indicates the use of saline diuretics. (3) *Urine with gravel or uric-acid deposits.* This indicates a tendency to the formation of calculi, and therefore the prophylactic treatment is much more important than the curative. Give plenty of pure water, or water which contains an excess of carbonic acid. Liquor potassæ may also be used in doses of half a drachm. If it is desired to render the urine alkaline, use the carbonate or citrate of potassium. The bitartrate and the acetate are the most active stimulants to the kidneys of the salts of potassium. (4) *The presence of bile in the urine.* When this occurs, the kidneys become irritated, and there is a tendency to the formation of uric-acid deposits. The treatment should be to promote vicarious action of the skin and bowels, and to administer cholagogues. (5) *Deficiency of urine, both in solids and quantity, due to renal congestion.* This may be artificially produced by varnishing the skin, thus interfering with its excretory functions. A very similar condition to this exists in the desquamative stage of scarlet fever, it being immaterial whether the desquamation be in large flakes or small scales. Therefore in this disease, as also in *scarlatinal* and *acute nephritis*, the object should be to re-establish the normal secretion of urine, and so diuretics should be given. (6) *Deficiency in the quantity of urine in dropsical affections.* This is due to the action of the kidneys being interfered with by the accumulation of fluid in the abdomen. The endeavor must be made to remove this mechanical obstruction before the diuretics are given, otherwise it will be very difficult for them to act.

Digitalis.

The leaves of the Digitalis purpurea, or purple foxglove, a plant growing wild in Europe. As a diuretic, digitalis acts by increasing the propulsive power of the heart and raising the general arterial pressure. It produces a free flow of pale urine of low specific gravity, and its action, when once started, often continues for four or five days, resulting in considerable prostration of the system. Its diuretic power is not decreased when used as a diaphoretic. Where there are idiosyncrasies its action may be uncertain, and if the arteries are diseased there is always danger from the rupture of a blood-vessel, owing to the increased arterial tension. It is especially indicated in cases of *acute nephritis*, as the stimulant diuretics—*i.e.*, those which act by causing a determination of the blood to the kidneys—are not to be given, as they intensify the renal congestion produced by the disease.

Mercury.

This substance, in combination with some other diuretic to direct its action to the kidneys, is the most reliable remedy in *chronic Bright's disease*, as it liquefies and causes to be absorbed the hyaline material which surrounds the arteries, hardening and constricting them, and setting up a slow process of inflammation which destroys the glandular structure. In chronic renal disease, the specific gravity of the urine is the index of its course. At first the specific gravity falls to 1.010 or thereabout, and remains stationary for a long time, and falls again at the close of the disease. When it reaches 1.006, danger is imminent. Calomel increases the watery flow of the urine, but not the solids. One grain each of calomel, squill, and digitalis is a good combination, and when the pulse becomes intermittent leave out the digitalis. One-twenty-fourth of a grain of corrosive sublimate and a grain each of quinine, squill, and digitalis is also a good formula. When the use of mercury is to be continued for a long time, the preparations with corrosive sublimate are to be preferred. The above formulæ can be used in *dropsy*, and especially in *cardiac dropsy.*[1]

Squill (Scilla).

This drug is obtained from the bulb of Urginea Scilla. It is very irritant to the mucous membrane of the stomach and intestines. When given in one to three-grain doses, it stimulates the pulse and causes determination of the blood to the kidneys; afterwards it depresses the heart and becomes an expectorant. It should always be combined with other diuretics.

Turpentine (Terebinthina).

The turpentine class of diuretics are active stimulants of the kidneys, producing arterial hyperæmia even in a healthy person, and, if their use is continued, congestion; and the urine, which at first is albuminous and then bloody, becomes deficient in quantity; and, finally, there may be strangury with irritability of the whole genito-urinary tract. For the three sets of nerves in this region—viz., those to the kidneys, to the neck of the bladder, and to the glans penis—are intimately associated, so that irritation of the neck of the bladder[2] will cause irritation of the kidneys and sensation of pain in the glans penis. Therefore, when these diuretics produce renal congestion, there will be a painful sensation, referred to the anus or penis, causing a constant desire to micturate, and producing strangury because there is no water to pass. This irritation of the urinary tract is a serious matter; death sometimes resulting, in persons over sixty, from the passage of a sound, which causes a sensation of chilliness and suppression of urine very difficult to treat. This suppression is difficult to account for, unless it is an illustration of the extreme sensitiveness and intimate relation of that part of the body to general vitality. In giving this class of diuretics, therefore, constant watch should be kept for these symptoms, many people having an idiosyncrasy against their use, so that great care has to be taken in their administration.

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[1] See also page 108.

[2] An injection of gtt. xiv.-xv. of fl. ext. of conium is to be given in all cases of pain in the neck of the bladder, and this treatment may also prevent the dangers following the use of the sound.

These diuretics are useful in the treatment of chronic inflammation of the urinary passages, such as *chronic pyelitis*. This disease may be diagnosed in the following manner: Have the patient pass his urine in three different glasses. If the glass which contains that which was passed first contains the most pus, then the disease is *urethritis;* if pus is most abundant in the second or in all three equally, *pyelitis;* and if in the third, *cystitis*. Hæmaturia may be determined in the same manner. Turpentine is valuable in the treatment of diseases of the *uterus*, as in *painful dysmenorrhœa* which is spasmodic in character and shown by pain coming on before the flow. *Chronic bronchitis*, with offensive breath, is benefited by its use in doses of five to ten drops. In the latter stages of *typhoid fever*, turpentine, which is also a valuable disinfectant in twenty-four-drop doses, is very good; but as soon as the desire to micturate becomes frequent, discontinue its use.

Buchu.

Buchu leaves are the leaves of several species of Barosma, a shrub growing in South Africa; the infusion has a strong aromatic odor, due to a volatile oil which readily yields to alcohol and water. It is very safe, never producing strangury, but it may cause disturbance of the stomach. Buchu is very valuable in the treatment of *cystitis*, especially when the stomach is irritable and weak, as it is borne much better than turpentine. If it is necessary to reduce the acidity of the urine, liquor potassæ may be added:

℞ Tincturæ Belladonnæ, ...	ʒ i.
Extracti Buchu fluidi, ...	℥ i.
Liquoris Potassæ, ...	ʒ vi.
Syrupi simplicis, ...	℥ ss.
Aquæ, ...	ad ℥ vi.

M. Sig. Teaspoonful every three hours. (For chronic cystitis.)

It is also used in the *spasm of the urethra*, being an *antispasmodic* of the genito-urinary tract, and the infusion or the fluid extract may be used in *bronchitis* and *phthisis* with purulent exudation and spasmodic cough.

Buchu is used to assist in the differential diagnosis of kidney disease. If it is given to a person with a small, contracted kidney, its odor will not be noticed in the urine, otherwise it will. Buchu and paregoric should be given in all cases of injury to the spine, to prevent *pyelitis* and *cystitis*.

Juniper.

Juniper is the fruit of the Juniperus communis. It contains an officinal volatile oil which forms the basis of the preparations representing the drug and upon which depend their medicinal properties. In cases of irritable stricture of the urethra, in atony of the bladder (a condition which interferes very decidedly with the action of the kidneys), and in *dysmenorrhœa* when there is a constant desire to micturate, juniper combined with gin is an effective diuretic. It is also very useful as a diuretic in dropsy not dependent on acute renal disease, *e.g.*, cardiac or hepatic dropsy. In large doses, juniper causes strangury and renal inflammation, and its use should not be continued if the first dose is unsuccessful. It is, however, better borne by the stomach than either buchu or turpentine (dose, gtt. x. in tablespoonful of gin).

SALINE DIURETICS.[1]

These, in addition to their action as diuretics, are also useful by being powerful oxidizers, and are to be used in febrile conditions. In *pneumonia*, it is well to add to the saline diuretics an ether, to direct their action both to the kidneys and to the sudoriparous glands. Of the saline diuretics, those of the potash series are the best. Potassium acetate is the most diuretic (dose, ʒ ss.).

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[1] See also Mineral Waters, p. 101.

The citrate of potash is the most palatable. It should be diluted very freely with water (dose, gr. xx.).

As diuretics the nitrate and chlorate of potash should not be used when the kidneys are inflamed or irritated.

4. *Diaphoretics.*

Diaphoretics, or sudorifics, are medicines which increase the amount of perspiration. They are mainly used as eliminatives, but sometimes they are used for the purpose of reducing the temperature when this is above the normal. In *fevers*, for example, the skin is hot and dry, a condition which is invariably accompanied by thirst, and the sensory nerves are irritated by the bed clothes; there is consequently great restlessness, which aggravates the disease by preventing sleep and raising the temperature. If perspiration be induced, the thirst will be allayed and the temperature lowered. So also in *diabetes*, when the skin is dry, the patient's constant thirst will be lessened if the skin be kept moist.

In using diaphoretics as eliminatives, it must be remembered that the skin is an eliminative organ only to a small extent, and only acts as such when the natural eliminative organs fail. Whenever, therefore, the skin is to be used for this purpose, it should always be prepared for this vicarious action, one of the first indications being to remove any existing tension of it; for when it has been dry for any length of time, the different epithelial layers are brought into close contact with each other, the orifices of the glands are closed, and thus the discharge of the secretions is prevented. This condition exists in *fevers* and generally in *dropsy*. In the latter disease, the dry skin is due to the subcutaneous effusion acting as a mechanical obstacle to the capillary circulation, and thus arresting the secretions of the sebaceous glands by lessening their blood supply. An inunction of oil, therefore, is a valuable adjuvant to the diaphoretics when these conditions exist, as this opens the mouths of the glands and separates the epithelial layers of the skin. After the patient has been oiled, as another adjuvant he may be wrapped in a hot-water pack.

Diaphoretics will not act when the other eliminative organs are in abnormal activity, and for this reason diaphoretics should not be attempted while the bowels are under the influence of a cathartic.

Diaphoretics may be divided into two classes: (1) External; (2) Internal.

(a) EXTERNAL DIAPHORETICS.

Dry Heat.

This is seldom used, as it is only effective when the skin is moist, and this condition is generally wanting.

Moist Heat.

Hot steam is absorbed by the skin, and should never be used as a diaphoretic. Hot water is one of the surest ways to produce sweating, but is very depressing. The best method is to use it in the form of a hot pack in the following manner: The body is first oiled, and the patient is then wrapped in a woollen blanket that has been moistened in boiling water and wrung as near dry as possible; over this a dry woollen blanket is wrapped, and around the whole a linen sheet. It should be assisted by warm diaphoretics internally.

(b) INTERNAL DIAPHORETICS.

Internal diaphoretics are divided into two classes: (1) Depressant; (2) Stimulant.

1. *Depressant Diaphoretics.*—These partially paralyze the heart and depress the arterial circulation, producing the cold sweat which is an invariable concomitant of a debilitated heart, as in fright, loss of blood, overdoses of colchicum, tartar emetic, aconite, etc. This class may be used when the skin is dry and hot, as in *fevers*. (For description of aconite, the principal member of this class, see p. 205.)

2. *Stimulant Diaphoretics.*—These give the warm perspiration of exercise. With the exception of jaborandi, these diaphoretics will not act if the skin is cold, some other action being produced, *e.g.*, Dover's powder becomes expectorant or diuretic, alcohol becomes diuretic, etc.; so that in administer-

ing this class it is necessary that the patient shall be kept warm.

Dover's Powder (Pulvis Ipecacuanhæ et Opii).

This is the most commonly used diaphoretic of this class. In the last Pharmacopœia, sugar-of-milk has been substituted for sulphate of potassium. Singularly, it can be made to act better by combining it with aconite, as this allays the surface irritability of nervous hyperæmia (Dover's Powder, gr. ij.–v.; Tincture of Aconite Root, gtt. v.).

Ammonia.

The preparations of ammonia in free doses are all diaphoretics, some, however, being more effective than others. Liquor ammonii acetatis (or the spirits of Mindererus) was much used at one time, but liquor ammonii citratis is now generally substituted for it (dose, ℥ ss.–i. every hour). The carbonate in gr. v. doses every hour is also very good.

Sweet Spirit of Nitre (Spiritus Ætheris Nitrosi).

This drug with a little alcohol in a hot drink acts well as a diaphoretic. All hot drinks, and hot water itself, produce better diaphoresis if slowly sipped than if taken rapidly; the process of sipping relaxing the arteries and stimulating the heart. To abort a *cold,* and for the first stages of *bronchitis* when there is a good deal of dyspnœa, hot dry skin, etc., a hot drink of lemonade, infusion of flaxseed, and a teaspoonful of sweet spirit of nitre, sipped two or three hours before going to bed, is very effective. While taking this drink, instead of putting the feet in hot water (which will only increase the susceptibility of the feet to cold, and probably cause a relapse on the following day), have the patient well wrapped up and let him sit in a warm place. The plan of giving a quantity of hot drinks during the night to induce perspiration is not to be recommended, as, although it works well for an hour or two, the patient is liable to catch another cold before morning.

Jaborandi (Pilocarpus).

The dried leaflets of Pilocarpus pennatifolius, a Brazilian tree. It contains several alkaloidal principles, the most important being pilocarpine, a colorless liquid, to which the chief effects of the drug are due. Jaborandi is unquestionably the most powerful diaphoretic known, and were it not for certain drawbacks it would be used very extensively. Its power is not increased by combination, and it is not necessary to endeavor to assist or increase its action by keeping the patient warm, etc., as jaborandi operates at all times, and it is only necessary to keep the patient from getting chilled.

The first effect of jaborandi is to cause flushing of the neck, which spreads quickly to the forehead, causing a sensation of dizziness; these effects appear almost immediately after it is given.

Sometimes it causes salivation, and if this is excessive and interferes with the diaphoresis, which usually lasts for about two hours, the use of the drug should be discontinued; if not, the salivation, if moderate, may be disregarded.

Jaborandi is particularly indicated whenever the skin is desired to act vicariously in the elimination of poisons from the blood; but on account of the very decided circulatory depression which it causes, it is contra-indicated in all conditions of *fatty* or *weak heart*. It should be used, therefore, in the anasarca of *acute nephritis*, *scarlatinal nephritis*, and in the *dropsy* of *Bright's disease* when the heart is strong, as in these conditions the drug works surprisingly well; but it should not be given when the heart is weak and begins to dilate, as, although sweating is produced, the patient is prostrated, and the dropsy is increased owing to the added weakness of the heart. It should not be given in *fevers*, nor should it ever be used in cases of *pregnancy* with albuminous urine and dropsy, as, although it is desirable to eliminate the urea which is being retained in the system and which may cause puerperal convulsions, jaborandi, by increasing the weakness of an already debilitated heart, may cause death. (Pilocarpine, gr. i.-ij., and Eau de Cologne, ℥ i., has been recommended to stimulate the growth of the hair.)

Dose of fluid extract of jaborandi, the most trustworthy preparation, ʒ ss.–i. Dose of pilocarpine, gr. ⅛–½ hypodermatically (this may be given twice a day in urgent cases of *Bright's disease*, especially in the young).

5. *Expectorants.*

Expectorants are drugs which promote the bronchial secretion, or modify its character so as to facilitate its expulsion, or which evacuate it with greater ease. Not infrequently the word is applied to any medicine used to relieve a cough. Expectorants may be divided into two classes: (1) Nauseant; (2) Stimulant.

1. Nauseant expectorants are really emetics in doses too small to cause actual vomiting. They increase the flow of mucus from the membrane of the bronchial tubes. In its normal condition, the secretions of the mucous membrane are not manifest, only a very small amount necessary for the moistening of the membrane being exuded. Tartar emetic and squill are the most reliable nauseating expectorants, the latter being most effective in combination.

2. Stimulant expectorants, so-called from their effect on the circulation, acting upon the veins of the mucous membrane. To this class belong the balsams and ethers, and, on account of the chloric ether it contains, perchloride of iron.

(The indications for the use of both the nauseant and stimulant expectorants are given in the following article on Coughs.)

Coughs.[1] A cough may be defined as a reflex act, whose single motor or efferent mechanism is called into play by a great variety of afferent impressions. Its one proper object is expectoration, but, much oftener than any other reflex act of the body, it occurs without its object, and is consequently useless. Coughs may therefore be divided into two classes: (*a*) Expectorant; (*b*) Non-expectorant or Useless. The distinctive character of all useless coughs is to be found in their sound, which is specifically different from the sound of any expectorant cough whatever. A non-expectorant cough, no matter if it be so constantly or rapidly repeated as to produce prolonged paroxysms, always consists of a series of acts distinctly independent of each other, and hence may be likened to the separate blows of a hammer. An expectorant cough, on the other hand, is never single. It may consist of only one act of real coughing, but, if so, it is immediately followed by a sound which indicates the clearing of the pharynx, which is the last step in expectoration as far as the respiratory tract is concerned. Generally, however, it consists of a number of coughs in which the sound distinctly connects each act, both with the one which precedes and with that which follows it, so that, instead of resembling the strokes of a hammer, it is more like the passing of the links of a chain over a pulley, or in some cases like the sound of a saw.

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[1] This article is a condensation of Prof. Thomson's paper on "The Significance of Cough with Reference to Treatment," read before the New York County Medical Society, December, 1888, and given by him in his lectures as an introduction to the subject of "Expectorants." It is published in full in the *New England Medical Monthly* of March, 1889.

(*a*) **Expectorant Coughs.**—These coughs are due to the presence of some material (which may be either a foreign body or secretion of fluid) in an air tube, causing a continuous imperative coughing until the offending material is removed. In the respiratory tract, there are certain sensitive areas, most marked at the bifurcation of the trachea and at the first and second divisions of the bronchi, and whenever a secretion collects in the bronchial tubes, so soon as it arrives at these sensitive parts the expectorant cough immediately begins, and does not stop until that place has been cleared. There may then be a lull until the secretion reaches another of these sensitive tracts, when the coughing again begins, and this process continues until the matter is finally expectorated. This continuous character of an expectorant cough is well illustrated in cases of chronic bronchitis with very viscid expectoration. The particle of mucus may be only a small globular but sticky mass, and yet, once started on its way, the patient has to devote his whole efforts in a succession of quick, powerful coughs, which it is impossible for him to check until he gets rid at last of a seemingly insignificant quantity for such a great and tumultuous effort.

The indications, therefore, for the treatment of expectorant coughs are simple, and there are only three: (1) to make the phlegm so liquid that it will flow easily; (2) to make the coughing powerful enough to be effective; (3) to check or diminish the amount of superabundant secretion.

1. *Remedies to render secretion less viscid, and so more easy of expulsion.*—The drugs ordinarily recommended for this purpose, such as mixtures of ipecacuanha, squill, senega, chloride of ammonium, chlorate of potash, balsamic mixtures with opium, etc., while successful in a certain number of cases, are not at all satisfactory in others, especially where the coughs are more or less chronic. Now, all oils that are taken up in any quantity from the intestine will always produce a watery flow into the bronchial tract, especially if directed to that mucous surface by a local hyperæmia; much of the benefit of a flaxseed infusion in acute bronchitis being due to the oil of

the seeds. Accordingly, linseed oil seems to be indicated for the treatment of expectorant forms of cough, and it has been found by actual experience a most efficient remedy for this purpose. An initial difficulty was to make a stable palatable emulsion of the linseed oil, but this has now been overcome.

The formula for the emulsion is:

℞ Olei Lini	℥ xv.
Olei Gaultheriæ,	
Olei Cinnamomi,	āā ʒ ij.
Chondri (Irish moss),	℥ ss.
Aquæ,	℥ xxiv.
Glycerini,	ʒ v.
Syrupi simplicis,	℥ x.
Acidi Hydrocyanici dil.,	ʒ iiss.

Of this emulsion the usual prescription for acute bronchitis is:

℞ Misturæ Olei Lini,	℥ vi.
Chloral,	ʒ iss.
Morphinæ Sulphatis,	gr. iss.

M. S. Tablespoonful an hour after meals, and, if the coughing is severe at night, a fourth dose at bedtime.

In order to allay the element of nervous irritability caused by the inflammatory condition of the bronchial mucous membrane, there should be added to each tablespoonful of the emulsion six to eight grains of chloral and from $\frac{1}{16}$ to $\frac{1}{8}$ of a grain of morphine. This emulsion is to be relied on, not only in acute bronchitis, but also in the most chronic forms of the disease where the expectoration is viscid and adhesive. It is an invaluable prophylactic against emphysema, and it not improbably serves as a direct nutrient of the pulmonary tissue. It is also of decided value in the treatment of bronchitic asthma, as well as in the asthmas which have a history of sequence to pertussis or measles.

Another frequent indication for its administration is in the treatment of phthisis in patients who cannot take cod-liver oil, particularly in those who have much bronchitis. Of course, it can hardly claim to possess the nutrient properties of cod-liver oil, but it is much more easily borne by the stomach, and as a substitute for it, where such has to be found, it is much superior to cream or other proposed substitutes. In many phthisical cases also that can take cod-liver oil, but in whom the cough is very racking, the emulsion may be temporarily administered to relieve the cough by changing the character of the expectoration. It is not to be used in cases of capillary bronchitis or broncho-pneumonia, nor in those cases of bronchitis occurring during epidemic influenzas where profuse nasal catarrhs alternate with bronchitis, as here the coughs are of infectious origin and generally have to run their course. The same may be said of intercurrent bronchitis in fevers, as those depend often on pure muscular weakness of the bronchial walls combined with cardiac failure from the fever; also in secondary bronchitis of heart disease, as well as in toxic bronchitis from gout, Bright's disease, etc., and in all cases of bronchorrhœa, whether senile or from bronchial palsy in fibroid degeneration of the lungs.

2. *Remedies to make the act of coughing powerful enough to be effective.*—A condition in which expectorant power is often imperatively needed is the capillary bronchitis or pneumonia of young children or infants. Here recourse may be had to the physiological association [1] which exists between the œsophagus and respiratory tract; for it has been shown that each act of swallowing produces a distinct stimulant effect upon the heart as well as upon the mechanism of expiration, and hence in the severe dyspnœa of children's pneumonia the little patients should be kept for prolonged periods swallowing half-teaspoonful doses of hot milk and lime water, to aid their failing power of expectoration. On the same principle, the sipping of a cup of hot coffee for phthisical patients before they rise in the morning, to facilitate their fits of morning expectoration, is to be recommended.

3. *Remedies to check or diminish superabundant secretion.*—The indication for these remedies occurs especially in the passive bronchorrhœa of old persons, in cardiac weakness, and in most cases of chronic bronchitis with emphysema. For many such cases of chronic bronchitis there is no better treatment than with the *Tinct. Ferri Muriatis* to tone the heart and weakened bronchial muscles. Along with this action may be found that of the adjuvants, Tr. Nucis Vomicæ, Digitalis, Citrate of Caffeine, and Sweet Spirit of Nitre. In other cases, as in phthisis with profuse bronchial discharge, dilute nitric acid is indicated to check secretion, and occasionally a very good effect may be obtained in these cases from three-grain doses of zinc oxide.

(*b*) **Non-expectorant or Useless Coughs.**—These coughs, of which there are no less than fourteen kinds more or less common, do not subserve any good purpose, and the aim, therefore, should be to arrest them. The nature of these coughs with their appropriate remedies will be dealt with in their order.

1. *Coughs due to simple inflammatory irritation* without secretion of some portion, or the whole, of the respiratory tract from the epiglottis down to the third division of the bronchi. A typical instance of this is to be found in the purely hyperæmic stage of acute bronchitis, when, with a tumefied and dry state of the bronchial mucous membrane, we find the patient much oppressed for breathing and constantly tormented with a frequent short and hacking cough, each act of coughing evidently increasing his sense of soreness and tightness of the chest. Auscultation reveals a number of dry, whistling râles, often more pronounced on expiration.

To turn the cough into the expectorant variety as soon as possible, nauseant expectorants which start secretion should be given. For this purpose one grain of tartar emetic should be dissolved in a teacupful of water, and the patient directed to take a teaspoonful every ten minutes until he begins to be nauseated, when usually the dyspnœa vanishes and the cough becomes loose.

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[1] For other examples of this physiological association, see pp. 277 et seq.

A much more common example of this cough, however, occurs in the course of ordinary bronchitis, both acute and chronic, where, owing to the fact of the co-existence of secretion and more or less free expectoration, its presence may be overlooked and it be confounded with the expectorant cough. In these cases, the patients have a number of distressing and painful separate hacks without bringing up anything, their cough, however, every now and then terminating in the continuous expectorating kind. In all such cases, though there may be considerable secretion, yet it is unequally distributed in patches of viscid coating with inflamed spaces between, and particularly if the dry surfaces are about the bifurcation of the bronchi. These cases of mixed expectorant and non-expectorant coughs are especially frequent in the course of phthisis, as we then have ulcerated conditions in the track of decomposed pus expelled from vomicæ or from pouches of dilated bronchi. It is necessary, therefore, to listen to the patient's coughing in order to determine the ratio between the expectorant and the non-expectorant sounds, and, if there be a considerable number of the latter, to add the sedative neurotics to the cough mixture. Of these, a small dose of chloral with a small dose of morphine (which is better than a full dose of either separately) is to be given, with the addition of aconite in febrile cases. Eight grains of chloral and one-eighth of a grain of morphine for an adult are quite sufficient. These neurotics are to be given for the non-expectorant element in the cough exclusively. So far as expectoration itself is concerned, they are drawbacks and not helps. In the passive bronchorrhœa of the aged, with dilated hearts, in chronic bronchitis with bronchiectasis and emphysema, in capillary bronchitis, in pneumonia, and, lastly, in all conditions in which there is abundant secretion, they are not only useless, but may be quite mischievous, and they have no place in a cough mixture, unless the sound of the cough betrays much useless irritation as a complication.

2. *Cough due to pure inflammatory irritation of the pharynx.*—This is common enough in ordinary colds, and not infrequently the precursor of *laryngo-tracheitis* by extension. It is, however, one of the most obstinate troubles of advanced phthisis, giving rise to a constant tickling sensation in the throat which has been wrongly ascribed to reflex irritation from ulcerated surfaces lower down. For this, and for the same distress in phthisis, apply a powder of one grain of morphine to five of starch, with a brush, low down in the throat, as this often enables patients to get a night's rest from the arrest of the prolonged paroxysm of coughs, which otherwise would rarely stop until vomiting changed temporarily the sensation of the throat.

3. *Coughs due to irritation of the pleura.*—The importance of recognizing a pleuritic origin or element in a cough can scarcely be overrated. Many cases of permanent damage to the lungs, including the induction of phthisis

itself, might often be prevented if the frequent origin of a chronic cough in a pleuritic adhesion were more commonly recognized. Post-mortem revelations show that of all serous inflammations, those which lead to pulmonary adhesions are the most common, often where they had not been at all suspected. There is generally a prolonged tendency to short, hacking cough after the patient has recovered from an attack of severe pleurisy. (The only exceptions, and these are only apparent exceptions, are in cases of hydrothorax with renal disease, for in them the effusion is often too watery to leave adhesions after absorption.) These patients are specially prone to have their cough return with changes of the weather, a common source of aggravation of all symptoms due to adhesions of serous membranes, as in pachymeningitis, for example; but because their cough returns, then they are apt to ascribe it to their catching a fresh cold. The treatment should be to strap the whole affected side for six months or more after every attack of general pleurisy (explaining to the patients the necessity of the procedure), to allow of as perfect rest as possible to this unresting respiratory surface, as otherwise the embers of the original inflammation will not go out and a permanent source of pulmonary mischief will remain. The immediate relief to the constant sense of uneasiness in the side, and the cessation of the useless, ominous, hacking cough which accompanies that uneasiness, very soon reconcile the patient to the trouble of wearing the straps. There are, however, many other conditions besides simple pleurisy where these considerations will apply. Whenever patients have the ordinary signs of phthisis, ask if they have been troubled with rheumatic pains about the shoulders. The answer will be frequently in the affirmative, the patient adding that he has often a pain behind the scapula, worse in stormy weather. These pains are sure to give rise to useless cough, the familiar, dry, hacking cough of early phthisis. As a means of diagnosis, laying the cold hand on the infraclavicular space over the affected part will immediately elicit several sharp hacks, when the same procedure tried first on the unaffected side will not do so. But a still more decided example of this kind of cough, and with much more injurious effects, is when a vomica has contracted extensive adhesions in front. The patients often then complain of an acute incisive pain through the lung, which constantly excites more coughing. Now, in both the early stages, and still more in vomical, this pleuritic cough cannot be otherwise than harmful and provocative of increased inflammation in the surrounding parts. When, therefore, the phthisical process is limited to one lung, invariably strap that side, and keep it so for months together.

4. *The spasmodic cough of pertussis.*—This cough is specific in its kind, and not due to bronchitis. It may, therefore, be wholly suppressed in less than a week and not return, though the disease remains and runs its natural course, and may remain as infectious as ever without there being any cough present. If, however, the patient contract a cold before the six weeks are over, the whooping cough at once comes back and is then quite intractable

to the measures which at first arrested it, showing that the irritation of simple bronchitis plays the same rôle in inciting the nervous irritability of pertussis that bronchitis does in exciting asthma. To arrest the cough or pertussis, bring the patient as rapidly as possible fully under the influence of belladonna. Nothing short of doses which will produce the physiological effects of the drug should be tried. In children, the dose should be enough to produce flushing of the skin, and repeated every two or three hours, night and day, for a week, after which the intervals of the doses may be gradually lengthened. Five grains of chloral may be added if, after the third day, the belladonna does not seem to have the full desired effect.

5. *The tracheo-laryngeal cough in children, occurring mostly at night and due to malarial infection.*—It is quite paroxysmal and strongly suggestive of whooping cough. A sign upon which a good deal of reliance may be placed as a diagnostic of a malarial infection in children is the presence of blood-corpuscles in the urine under the microscope. Children with these malarial coughs often rise in the morning tired and fretful, with no appetite, with brownish-yellow coating of the tongue and considerable pharyngeal redness; but during the day they scarcely cough at all. If a small number of blood-corpuscles are found in the urine, a few doses of quinine are sufficient to arrest the cough.

6. *The nocturnal cough of children* from some irritation in the alimentary canal, such as from indigestion, the presence of worms, etc. These should be treated by removing the cause.

7. *The uterine cough.*—If it be meant by this term that the cough is associated with disorder of the female generative functions or organs, it is correct enough; but the starting point of the irritation may not be from the uterus, but rather from some of its accessories. This cough is often the loudest of all coughs, as in some hysterical women. Like other accompaniments of hysteria, its treatment is most successful with purgatives like cascara, aloes, and rhubarb, with intestinal antiseptics like benzoate of soda, salol, and camphor, with the usual adjuvants of myrrh, asafœtida, and valerian, and the bromides. On the other hand, in women more advanced in life there may be a local cause in the cervix uteri, the removal of which may be all that is necessary. The cough of chlorotics, which so often excites alarm as likely to be from phthisis, is doubtless of the same general character.

8. *The aneurismal cough.*—The diagnosis may be facilitated by listening carefully over the trachea to the persistent croupy sound of the breathing, no matter how quiet the respiration may be. This cough is best relieved by morphine, but it is surprising how often its most distressing paroxysms can be warded off by a couple of leeches to the notch of the sternum.

9. *The cough produced by enlarged bronchial glands pressing upon the pneumogastric nerve.*—This may be one of the earliest signs of phthisis, but, if so, it wholly differs in its nature and associations from the early pleuritic cough. It is almost invariably accompanied by excessive sensitive-

ness of the pharynx. Very often this goes along with hoarseness or even aphonia and intractable vomiting, although there may be no vomica or scarcely any pulmonary symptom present. At other times there is a good deal of palpitation of the heart. In these cases, the normal bronchial breathing between the scapulæ is much intensified. The hoarseness and vomiting will both cease after a while, usually with softening of the implicated glands, but all the symptoms, including the cough, can meanwhile be greatly relieved by repeated dry cupping between the shoulders. Of course this kind of vomiting with hoarseness in phthisis is wholly different from the same symptoms later on.

10. Another example of purely reflex coughs is mentioned in text-books on diseases of the ear. Foreign bodies in the external auditory canal are especially prone to occasion it, and if we cannot find the reason for paroxysms of apparently causeless coughing, we had better look for plugs of hardened wax in the ear as a possible explanation.

Finally, we have the coughs of mitral insufficiency and of cardiac dilatation. Also the cough from irritation of the phrenic nerve in perihepatitis, and even in abscess of the liver, as well as in some cases of splenitis, each of which is to be recognized by its sound as having nothing to do with expectoration of matter from the lungs, each also requiring its own and not a routine treatment. There remains one cough, however, which is always of grave import; namely, the cerebral cough. In a few cases of epilepsy, it may indicate nothing but a functional irritation, but when associated with symptoms of cerebral mischief it points to organic changes or irritative lesions affecting the cough centre in the medulla oblongata. This is particularly apt to be excited by affections of the under surface of the cerebellum, or by effusion, abscesses, or tumors pressing the cerebellum down upon the medulla.

DIVISION III.—ASTRINGENTS.

Astringents are medicines which constringe muscular and fibrous tissue and diminish secretions, and are also employed for arresting hæmorrhage by coagulating the blood. They act chemically upon the tissues, and, unlike the other medicines, do not assist one another by combination. They are divisible into: (1) Mineral astringents; (1) Vegetable astringents.

1. *Mineral Astringents.*

Lead (Plumbum).

Lead is the most valuable member of this numerous class. While all other astringents, mineral and vegetable, given in large doses, are very irritant to the mucous membranes, especially to that of the stomach, the acetate of lead (the only form of lead used for internal administration) does not have this effect. Therefore, where vomiting and purging are going on simultaneously, as in *choleraic diseases*, no medicines being retained owing to the irritability of the stomach—vomiting being the exact opposite of absorption, not only in the act of expulsion, but in abstracting watery flow from the blood—an astringent must be given, and the acetate of lead is the only one that can be used: for (1) it is markedly sedative; (2) it is antiphlogistic; (3) it is an astringent. It is the most powerful astringent for *diarrhœa*, but should only be used as a last resort in that form of diarrhœa dependent upon intestinal fermentation where a great deal of irritation has occurred (antiseptics, with a little opium if there is pain, should be the treatment in the early stages of this disorder). The acetate must be combined with calomel as an antiseptic, and with opium to assist in allaying the pain and irritation. In *cholera infantum*, when time must not be lost, gr. $\frac{1}{12}$ calomel, gr. i. acetate of lead, gr. i. tannin, should be given.

For *choleraic diarrhœa with vomiting* in an adult, the following can be given:

℞ Plumbi Acetatis,	gr. xij.
Pulveris Camphoræ,	gr. xij.
Pulveris Opii,	gr. iij.
Bismuthi Carbonatis,	gr. xij.
Extracti Gentianæ,	q. s.

M. et ft. pil. No. xii. S. One pill to be given after every movement of the bowels.

The following is useful for *cholera infantum with vomiting:*

℞ Hydrargyri Subchloridi,	gr. i.
Plumbi Acetatis,	gr. iv.
Pulveris Camphoræ,	gr. iv.
Saccharat. Albæ,	gr. xij.

M. et ft. pulv. No. xii. S. One powder every hour with a little water, and, if an anodyne is necessary, give one-half drop of laudanum rather than powdered opium. If vomiting and purging continue, one powder should be given after each attack.

Patients who are confined to their beds for a long time are much emaciated, or suffer from the formation of *bed-sores* and severe neuralgic pains due to pressure on nerves. These may be prevented by placing under them a sheepskin or bear robe, and covering with a sheet. The parts should be rubbed with: ℞ Tannate of Lead, ℥ i.; Simple Cerate, ℥ i.

Lead and opium washes are excellent applications for *erysipelatous inflammations of the skin.* They can be made in strength of gr. iij.-v. of the acetate of lead to ℥ i. of the solution of morphine (U. S.). The mixture should be well shaken before using, as lead is incompatible with morphine, and so forms a precipitate. If continued for any length of time, this wash is apt to produce lead poisoning, a result which is to be carefully avoided.

Lead Poisoning.—The sources of lead poisoning are numerous; those engaged in occupations requiring the use of lead, as painters, etc., are most frequently affected, but it is also common in country districts from the water being conveyed from the well to the house in leaden pipes. Lead poisoning is very insidious in its approach, and, owing to the obscurity of its symptoms, the diagnosis is difficult till neuralgias and liver troubles furnish the clue. The first symptom is what the patient calls rheumatic pains, because they are worse when the weather is about to change; but that the pains are not rheumatic is shown, firstly, by the fact that they are not localized, *i. e.*, confined to any one joint, but travel over the course of the great nerves; and, secondly, the patient presses with his hand upon the seat of pain, thus showing that it is neuralgic, not inflammatory. After this there is a slow loss of strength and general cachexia, lasting for months, the patient continuing to suffer from neuralgias, headaches, and finally, owing to disordered liver, there will be considerable jaundice. The pulse is now of high tension, and many symptoms are developed closely resembling those of gout. The next most important symptoms from rapid absorption of lead, as in the case of painters, are localized pain in the rectus abdominis and lead colic, the latter symptom being distinguished from *hepatic* and *renal* colic by the pains coursing only from the umbilicus to the pubes, and not extending to the back. Whenever severe abdominal pains occur without any inflammation, and it is certain they are not those of hepatic or renal colic, suspect lead poisoning. If the pain be in the rectus abdominis, the faradic current will enable us to apply a pathognomonic test; for the same effect will be produced upon this muscle by lead poisoning as upon the extensors of the arm, viz., the faradic excitability is reduced while the neighboring muscles are unaffected. Along with the colic, the patient is apt to be extremely constipated. After a time the grasping power of the hands and fingers will be weakened, and there will be "wrist-drop." Both hands are usually affected, and this symmetrical weakness is one of the signs of the disease. Next the deltoid muscles are affected, with consequent inability to raise the arms to any extent, and, lastly, the interossei muscles will be paralyzed. Another symptom will be the deposit of sulphide of lead on the teeth, or mucous membrane of the mouth, in the form of a blue line, but absence of this blue line does not prove that lead poisoning is not present, for the teeth, for instance, may be false or have been constantly cleansed.

Treatment of Lead Poisoning.—The peripheral neuritis causes degeneration of a fatty kind of the muscle-cells of the affected muscles, which become almost saponified. The iodide of potassium should be given, and the patient brought rapidly under its influence until symptoms of iodism appear (dose, gr. x.–xx., or as much as the patient can bear, t. i. d. for a week). For the first three or four days, while the lead is being dissolved and eliminated, the pain will be increased.

The faradic current must early be applied to the muscles, as, if left for any length of time without treatment, they may never recover. The interossei are the most difficult to restore, but, as with the rest, it can be done by the patient and persistent use of the faradic current to each muscle separately. The irritability produced by the current causes an increased flow of blood to the part, making it warmer, increasing it in bulk, and awakening susceptibility to motor influence.

Liquor Ferri Subsulphatis,

Or Monsel's solution, is the most astringent and the least irritating of any of the salts of iron.

Liquor Ferri Pernitratis,

In doses of six to ten drops, is often used in the *diarrhœa of phthisis* and in *chronic dysentery*.

Nitrate of Silver

Is a very active astringent; as a caustic, a very small amount ($\frac{1}{100}$) of what is applied acts, since it unites with the albumin of the tissues, forming the albuminate of silver. It is useful in checking bleeding from the alimentary canal. A good formula for *chronic dysentery* or *chronic diarrhœa* is:

℞ Argenti Nitratis,	
Pulveris Opii,	āā gr. v.
Terebinthinæ Resinæ,	ʒ iij.
Sodii Bicarbonatis,	ʒ ss.

M. et fiant pilulæ No. lx. Sig. Three pills t. i. d

Sulphate of Copper

Resembles the nitrate of silver in its astringent and caustic properties. When given internally in large doses, it acts as an emetic, from its irritant action. It can be substituted for the nitrate of silver in the above formula. Locally, it is the best application for *chronic conjunctivitis*. It should be applied in substance quickly and lightly to the granulations.

Alum.

Alum is largely used as a styptic, in domestic practice, to check bleeding. A paste made of alum, capsicum, and honey is very good for *relaxed uvula*.

2. *Vegetable Astringents.*

Tannin—Tannic Acid.

Vegetable astringents are very numerous, and many of them were much used formerly in the treatment of diarrhœa, etc., but now tannin, which is the active principle of all vegetable astringents, is generally preferred. The powerful astringent qualities of tannin depend chiefly upon its property of coagulating albumin and gelatin. Taken into the system, it causes hardening and shrinking of the tissues, both nervous and muscular, and on this account is of great use as a medicine where there is vital relaxation showing itself, more particularly in weakness of the vascular system, which results, as in vaso-motor paralysis, in cold sweats, nervous sweats, exudations from mucous membranes, as in *chronic nasal catarrh*, *lachrymal discharges*, *watery diarrhœa*, etc., conditions that call for astringent as well as tonic treatment. Tannin, given alone, deals only with the symptoms, not with the disease itself; so that tonics are necessary to remove the cause by strengthening the heart, etc. Cold may also be used for the local treatment of these mucous discharges. Tannin is a good appetizer (dose, gr. ij – iij.). Given in combination with quinine, it promotes its action and disguises its taste (quinine, gr. iij -iv.; tannic acid, gr. i., which must be shaken, if in solution, as a precipitate is formed). It also assists the action of the mineral acids and does not produce much constipation (dose of tannin, gr. iij.-iv., repeated at least four times a day). The addition of water to tannin changes it from tannic acid to **Gallic Acid**, which has some slight differences chemically, and medicinally it is not so astringent as tannin. Both are excreted by the kidneys, giving the urine a dark, smoky color, and therefore may be used in suppurative inflammations of the kidneys, as in *chronic pyelitis*. They may also be given for *chronic cystitis*. Tannin may also be used as a local astringent to check hæmorrhage, and in the form of a tampon is used by some obstetricians for this purpose; but in *post-partum hæmorrhage* tannin should not be used under any circumstances. When the sputum has been slightly tinged with blood for several days, tannin may be given in *hæmoptysis*, but not if it is very free.

PART III.

NON-MEDICINAL REMEDIES.

NON-MEDICINAL REMEDIES.

Non-medicinal remedies are those which act without entering the circulation, as counter-irritants, blisters, caustics, electricity, heat, cold, baths, change of scene or of air, massage, etc.

THERAPEUTIC MEASURES.

Cold.

Physically, cold is the absence of heat. Therapeutically, it is a positive agent, and has five actions:

1. Tonic.
2. Styptic.
3. Antiphlogistic.
4. Anæsthetic.
5. Antipyretic.

In the first three, cold acts upon the vaso-motor (not upon the cerebro-spinal) system as a pure irritant neurotic. In the last two, it acts partly on physical principles, partly as a neurotic.

1. *Cold as a Tonic.*

When cold acts as a tonic, it is an irritant. Every irritant produces a shock and causes an expenditure of the energy of the part irritated, which, therefore, becomes depressed; but this depression differs from that produced by a simple sedative, in that it is followed—provided the shock is not so great as to cause exhaustion—by a *reaction* to or beyond the condition in which the part was prior to the irritation. Thus, cold, as an irritant, affects the vaso-motor system and produces a shock which is followed by a reaction. In other words, this system is exercised, and all moderate exercise tends to strengthen the organ called into action, and permanently to improve its nutrition. Cold, then, is a vascular tonic, and may be used generally or locally. When the circulation is feeble and there is loss of muscular power, the general use of cold will arouse the heart, restore arterial tone, and thereby improve the nutrition of the whole body. For this purpose either the dip-, shower-, or sponge-bath may be used, according to the strength of the patient, taking care never to cause exhaustion by its too frequent or protracted use. A thorough reaction, as indicated by a glow of the skin, should always follow the bath, and never a sensation of lassitude or fatigue. When the irritant effect produced by the cold water alone is not sufficient, salt or some mild rubefacient may be added. In all cases, reaction may be assisted by friction with a rough towel.

Dip baths, sea bathing, etc.—The manner in which the general application of cold affects the system is shown by the sudden stoppage of the heart and short respiratory acts whenever the body is suddenly immersed in cold water. The arteries become suddenly contracted and the heart embarrassed, and it is to this cause, and not to cramp, that the deaths of good swimmers, whenever they plunge into extremely cold water, are generally due. It is not safe for persons to go in bathing who cannot stand a cold bath without loss of breath, and in all cases it is well to accustom the vaso-motor nerves gradually to the severe exercise, as it may be termed, given to them by bathing. The extensive application of cold, if given as a remedy, must be of short duration. Most of those who go sea bathing are injured rather than benefited by it, because it is indulged in too frequently before the system has become accustomed to it. If the patient is too feeble to bear even the sponge bath, simple exposure of the surface of the body to cold air will often prove beneficial. The night sweats of *phthisical* patients may often be greatly relieved by having the patient get up during the night and exposing the skin until it is chilled, and then applying friction and returning him to bed. This has the same effect as an application of cold water, but, of course, in a less degree.

Hip baths.—These have an excellent action upon the circulation of the pelvic viscera where it is congested, as in *prolapsus recti, prolapsus uteri, chronic piles,* congested condition of the vagina with *leucorrhœa,* etc. The cold should be strictly limited to the part affected, the nerves above and below being well protected; and, as many of these patients are women with feeble powers of reaction, care must be taken that the application is not too prolonged. At first the water should be tepid, and the patient should not remain in it for more than five minutes, which may afterwards be increased to eight and the water made colder.

Shower baths, cold douche, etc.—In shower baths there is another element besides the irritation of the cold water, viz., the force of the falling water, which is extremely severe, though, being diffused, it is not felt so much. These should never be used by any one who has not strong powers of reaction, and should certainly never be given to a patient, especially one with cardiac disease. The shower bath is not so injurious, however, if confined to one part of the body only, as the head. Here it may be used for any sudden congestive condition of the brain with unconsciousness or convulsions, or where there is much hyperæmia about the head and scalp without any renal disease (it should never be used in Bright's disease), as in *puerperal convulsions, alcoholismus,* and in the convulsions of *scarlet fever.* In the latter disease, when it occurs in children and commences suddenly, with vomiting, high fever, and convulsions, pour water on the top of the head from the height of one foot, and keep on pouring until the child returns to consciousness; because, if the patient is allowed to remain in convulsions, the disease may terminate fatally. So in *meningitis,* when the patient is delirious or has a tendency to convulsions, cold water may be poured gently on the nape of the neck and on the head.

The cold douche may also be used for any circumscribed innervation or malnutrition dependent on local weakness of the circulation. For example, rheumatic joints are apt to remain stiff and swollen for months or years after the attack, because the local inflammation embarrassed a normally poor local circulation. Cold, which stimulates the absorption of the fibrous exudation of *rheumatism* clogging the joint, will often restore its natural condition, even after a long period. Water should be poured on it from a height of about two feet until there is an aching pain, when friction must be used. Pouring on hot water for a moment, by increasing the contrast, will produce still more beneficial results. If the stiffness of the joint be due to *gouty* deposits, cold is not of much use.

The cold douche or its equivalent is also of great use in vaso-motor weakness dependent upon *sunstroke* or *malaria*. After sunstroke, the patient is never the same again either physically or mentally. An injury has been done to the cervical ganglia of the sympathetic, and nervous control of the blood supply of the face and scalp, and possibly of the brain, has accordingly been weakened. The patient suffers from dizziness, flushing of the face, insomnia, and finally there may be meningitis or epilepsy, or such depression of spirits as may lead to suicide. Much good may be done by preventing the progress of the disease. Unfortunately, cold, ergot, and nitrate of silver are the only vaso-motor tonics we have. Therefore, as medicinal treatment:

℞ Argenti Nitratis, ...	gr. $\frac{1}{4}$
Ext. Ergotæ, ...	gr. iij.

M. et fiat pil. No. i. Sig. To be given an hour after each meal t. i. d. For one week in every month add corrosive sublimate, gr. $\frac{1}{24}$.

In addition, the cold douche should be applied to the nape of the neck every morning, keeping the back of the head dry, for, if not, it may cause coryza. In two or three months there will be marked improvement under this treatment.

What sunstroke does to the vaso-motor centres in the nape of the neck, *malaria* does to the centres in the lumbar region, causing vaso-motor weakness in the hepatic and splenic circulation. Any severe malarial infection will be felt for years afterwards, congestion of the liver or spleen following from slight causes, with chills, diarrhœa, jaundice, etc., and epistaxis. (If epistaxis is from the right nostril, the liver is affected; if from the left nostril, the spleen.) Quinine does no good here, as this is not a periodical disease, but the result of the weakening of the vaso-motor centres of the spleen and liver. Ergot, nitrate of silver, and corrosive sublimate should be used with cold douche to the spine, repeated at times to the abdomen, or over the liver or spleen, as the case requires. A cold douche to the nape of the neck is also useful in *false croup*, or the crowing respiration of children; in *tinnitus aurium*, when the throbbing is synchronous with the heart's beat, and the tympanic artery distended—in this condition, the simultaneous exhibition of hydrobromic acid is of value; in *chronic nasal catarrh* and in all cases of *unilateral headache* with corresponding dilatation of the arteries, and suffusion of the eye on the affected side.

2. *Cold as a Styptic.*

Cold acts as a *styptic* by causing contraction of the arteries through its influence on the vaso-motor nerves. It is preferable to astringent drugs and other hæmostatics, as it obviates the application of irritating substances to the bleeding part. It is not always necessary to apply it directly to the seat of the hæmorrhage, for it will also affect distant parts in accordance with certain laws of the vaso-motor system, of which the following are the most important.

The first law is that organs which exist in symmetrical pairs, such as the hands, the feet, the eyes, and the ears, are so closely associated in their vaso-motor relations that the same effect, so far as their circulation is concerned, is produced in both by an impression made only on one member of the pair. Thus a thermometer held in one hand will drop 14° F. if the other hand be dipped in ice-water, while a thermometer in the axilla at the same time will mark no difference. In like manner, if the tip of one of the translucent ears of a rabbit be sharply pinched, the pulsating arteries in the other ear will at once contract into invisibility. It is on this principle that injury to one eye is so dangerous to the integrity of its fellow by consecutive inflammation.

It is fortunate that organs that are not in symmetrical pairs, as the lungs and the kidneys, do not show anything like such a close nervo-vascular association.

The second law is that there is a close association between the sensory nerves of any part of the skin with the vaso-motor nerves of the organs or viscera which are immediately within that part, so that like impressions on the cutaneous nerves produce like effects on the circulation of the inner structures. Thus, if a cold hand be suddenly laid upon the præcordium, the heart will give a bound and for a moment stop; so a cold hand laid on the abdomen will cause the uterus to contract; a dash of ether spray on the chest is the quickest way to arrest an *hæmoptysis*, and a cold hand may often be used for the diagnosis of incipient *phthisis*. It may be tried by dipping the patient's own hand in cold water, so that he will not be so afraid of the procedure, and then laying it alternately over the right and left apex; if done suddenly, he gives a short cough when the impression of cold is made on the affected side, but not when the application is made on the other. This principle is also illustrated in the recourse to all surface applications in internal disorders, such as rubefacients, blisters, and faradism to stimulate absorption, or poultices, etc., to allay irritation. No physician, in fact, should neglect cutaneous protection in all acute internal inflammations, such as *pericarditis*, *pleuritis*, etc., and in every case of phthisis or chronic bronchitis.

The third law is that there are certain special vaso-motor associations of widely separated parts which have no obvious functional connection with each other. The first of these which we would mention is between the vaso-motor nerves of the pelvic viscera and those of the feet. Thus, females can stop menstruation by putting their feet in cold water, while, on the other hand, there is no emmenagogue which at all equals persistent application of dry heat to the feet; so also we find in males with an irritable *stricture of the urethra* or an *enlarged prostate*, that nothing aggravates their infirmity so much as getting the feet wet or cold. On the same principle, if surgeons are troubled with bleeding in cutting for stone in an old case of vesical irritation, putting the feet in cold water will suspend the hæmorrhage. Again, irritation in the pelvis contracts the femoral artery; so that coldness and anæmia of the feet is the rule in all instances of *ovarian irritation* in women, and in *cystitis* or *prolapse of the rectum*, etc., in men.

Another such association is between the feet and the circulation of the pharynx and larynx. Putting the feet in cold water is followed by an immediate paleness of the pharyngeal mucous membrane, in contrast with the rest of the mucous membrane of the mouth. This association is quite unmistakable and peculiar, and best shown in normal cases.

Still another such association is between the nape of the neck and the circulation of the nasal cavity. While the relations of the cervical sympathetic are known to be very wide in the control of the circulation of the face, head, and throat, yet the close dependence of congestions of the nasal cavity on abnormal innervation of the cervical nerves has not been as fully recognized as it should in the management of some of the obstinate maladies of a region in which vascular disorders are so apt to be tedious, because there is so little muscular tissue to aid in restoring tone to the affected structures.

As a summary, the following instances will suffice to illustrate the application of these laws in the use of cold as a styptic: (1) cold water applied directly to a bleeding surface; (2) ice bags to the epigastrium to check *hæmatemesis;* (3) cold applied to one hand to check *hæmorrhage* in the other; (4) cold foot baths to arrest *metrorrhagia ;* (5) in *post-partum hæmorrhage,* where the best way of applying cold is by the ether spray, for the sudden and intense impression produced causes contraction of the uterus without chilling the patient. If the ether spray is not available, cold water should be poured from the height of two or three feet. The shock of the falling water assists the action of cold. These same measures may be used to control *hæmoptysis.*

3. *Cold as an Antiphlogistic.*

As an antiphlogistic, cold may be used to arrest an *acute inflammation,* unless suppuration has occurred, or to prevent inflammation when threatened. This it does by causing a protracted constriction of the arteries, thereby preventing the active congestion essential to all acute inflammation. The inflammation must be local, both as to cause and manifestation, and not be dependent upon a constitutional cause with a local manifestation. It should be invariably applied as dry cold, directly to the part affected, in sufficient intensity to relieve pain, but not so as to produce shock and reaction, and should be continued so long as the exciting cause exists. If, before the tendency to inflammation has entirely disappeared, a neuralgic pain occurs, it is a sign that the vaso-motor nerves have become exhausted, and the use of cold must at once be discontinued, or gangrene will result; moreover, the patient will feel more comfortable without than with the cold applications. This neuralgic pain is continuous, and, if the injured part be one of the extremities, it extends from the part injured toward the trunk. Inflammatory pain, on the other hand, is local throbbing, accompanied by local heat, and is relieved by more thorough applications of cold. In *fractures,* or other severe injuries near joints, the injured parts should be completely surrounded with pounded ice placed in water-tight receptacles, such as pigs' bladders, rubber bags, etc., two or three layers of perfectly dry muslin being placed between the skin and bags, lest the parts be chilled too suddenly. A bottle filled with ice-water makes a good antiphlogistic splint for injuries of the hand. Inflammation of the eyes due to some external injury may be controlled, and its spread from one eye to the other prevented, by means of cold applications. If the inflammation is due to some internal injury of the eye, such as of the retina, cold will not control it. Ice bags should be applied to the head and spine in epidemic *cerebro-spinal meningitis,* and kept there during the whole period of the inflammation. Cold applications will control the spread of *erysipelas,* and are the best means for relieving *febrile headache.* Headache from uterine trouble is best relieved by moist warmth. Cold should not be used antiphlogistically in any acute inflammation of internal organs, except *peritonitis* with vomiting, and *meningitis.*

4. *Cold as an Anæsthetic.*

The use of cold as an anæsthetic depends upon its physical property of freezing tissue and deadening sensation without destroying vitality. It is most useful in operations where no great thickness of tissue is involved, as in opening abscesses, amputation of fingers, etc. In all cases, the effect of the cold should be secured as rapidly as possible. Apply ether spray to that part alone which is to be operated upon, the other parts being protected with some covering, such as chamois leather. Anæsthesia is complete as soon as the skin becomes white and glistening. Rhigolene may also be used for this purpose.

5. *Cold as an Antipyretic.*

It is only within recent years that we have been enabled to answer the exceedingly complex questions, what is the source of the heat when the bodily temperature is raised above the normal, and how far will its direct abstraction be beneficial? A rise in the temperature of the body may be caused in three different ways, each of which has been considered as the genesis of fever: (1) increased oxidation in the system; (2) insufficient radiation; (3) derangement of the thermic centres and nerves. It may now be accepted as proven, that while the first two may give rise to the symptoms of fever, or be its accompaniments, they are not its direct cause, and it is to the third, therefore, that we must look for the explanation of the pyrexia. Experiments upon animals have demonstrated the existence of a heat centre[1] in the corpus striatum which regulates the heat-producing function of the muscular system—a function which is entirely independent of muscular contraction, heat being evolved when the muscles are in a complete state of relaxation. Both heat genesis and heat lysis are under the control of the thermic centres and nerves, just as the circulation of the blood is under the control of the vaso-motor centres and nerves. Hence fever is due to a derangement of this thermic system, and neurotics such as aconite, and neurotic drugs of the carbolic-acid class such as antipyrine, are real antifebrile agents. Cold, therefore, which is an excellent neurotic, can be used as an antipyretic measure; for it not only directly abstracts heat, but also acts as a stimulant to the thermic centres, arousing them from the paralysis or derangement of the fever.

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[1] There may be another centre in the spinal cord opposite the third cervical vertebra, as injury to the cord above this point will sometimes raise the temperature to 125° F., and injury below it will sometimes reduce the temperature below that of the dead body. The existence of this centre may be assumed to exist, though it has not yet been conclusively proven.

This derangement is due to a variety of causes, mainly toxic —the poison of septicæmia, for instance, producing the most violent fever known; and probably all fevers, with the exception of that in sunstroke (see infra, p. 283), are due to some form of poisoning. In every fever there is a certain point beyond which if the temperature rises certain structural changes will take place. The glands become affected with cloudy swelling, their secretions are arrested and fatty degeneration ensues, and the muscles become remarkably brittle.

The point at which these changes occur differs in each fever. In scarlet fever, it is 105° F.; in typhoid fever, 106° F.; in relapsing fever, from 107° to 108° F.; and in erysipelas still higher. Beyond this dangerous point in each fever the temperature should not be allowed to rise, but must be lowered by the use of cold. This may be effected by immersing the patient in a bath at 70° F., and gradually cooling the water down to 65° or 60° F.—never lower—at the same time using cold affusions to the head continuously. At first the temperature will rise slightly, owing to the blood being driven from the surface of the body into the viscera, which are always a little warmer than the skin; but the bath should be continued until the temperature is reduced to 100° F., provided the fall is gradual—that is, one degree in six, five, four, or three minutes. Never allow the temperature to fall below 100°, and if the immersion has to be prolonged for more than twenty minutes before the temperature breaks, do not wait until the temperature reaches 100°, but take the patient out when it is 101°. If it falls one degree in two and a half minutes, stop the bath when the temperature has reached 101° F.; for in most cases a further reduction of one degree will occur after the bath has been discontinued. If the fall in temperature during the bath be one degree in two minutes or less, the patient should be taken out at once, whatever the actual temperature may be; for in such cases there is danger of the subsequent fall becoming uncontrollable, perhaps reaching 97° and causing the patient to pass into a state of collapse. Should this at any time occur, wrap the patient in warm blankets, apply hot water to the epigastrium, and give brandy or other stimulants. When for any reason the bath is impracticable, the cold pack[1] may be used, always observing, however, the same precautions as in the use of the bath. The cold pack or bath should be repeated often enough to keep the temperature below the dangerous point of the disease. If necessary, use one every hour; but if only two or three a day are needed, one should be given when the highest diurnal rise in temperature may be expected, *i.e.*, about two or three o'clock in the afternoon.

ANTIPYRETIC USES OF COLD.

In Acute Articular Rheumatism.—The application of cold is the only measure that will save life in the pyrexia of the severer forms of this disease. When this occurs, the patient becomes apathetic, ceases to complain of the pain in his joints, his face becomes dusky red in color, delirium sets in (an extremely bad sign in rheumatism), and this becomes intensified with every hour. Meanwhile the temperature has been steadily rising, and, if the disease terminates fatally, continues to do so even after death. When the temperature reaches 108°, the patient becomes comatose, and now death is inevitable unless cold is used, medicinal antipyretics being useless in this condition. Immerse the patient in cold water until the temperature of the body is reduced to 100°. When it is at 104°, the patient returns from coma to delirium, and when it is at 102° he is quite rational and will remain so for an hour or two, after which the temperature will begin to rise again, and the same process must be repeated. One-third of such cases will inevitably die, but with the remaining two-thirds the fever is broken by this treatment, the articular rheumatism resumes its ordinary course, and the patient finally recovers. This disease shows that heat alone is sometimes the direct cause of death.

In Sunstroke.—The same rapid elevation of temperature continuing after death, which occurs in the pyrexia of acute articular rheumatism, occurs also in about two-thirds of all the fatal cases of sunstroke. This condition is not due to any form of poisoning, as in the case of other fevers, but to the direct action of the sun upon the nape of the neck, deranging one of the thermic centres. Cold baths must be given in the manner already described. It must be borne in mind, however, that there are two entirely distinct conditions of sunstroke: in the condition for which cold is indicated, there will be coma, with elevated temperature, high tension of pulse, and the face will be suffused; in the other condition, for which stimulants and not cold are indicated, the face will be pale, the pulse weak and flickering, and the patient will be in a condition bordering on syncope.

In Typhoid Fever.—The application of cold in combination with the administration of intestinal antiseptics takes the lead of all therapeutic measures in the treatment of typhoid fever, as, in the great prostration and muscular weakness of this disease, cold directly abstracts heat from the affected muscles and keeps up their tone. When the patient is delirious, with dry skin, rapid pulse, etc., immerse him in a bath at 75°, and gradually make the water colder by the addition of ice, so that the initial shock shall not be too great, and the rise in temperature following immersion avoided. The temperature of the bath should not be lowered below 70°, or at most in severe cases 68°. After being taken out of the bath and placed in bed, the patient may shiver; if so, a slight dose of some stimulant may be given. His pulse is now stronger, the tongue is moist, he is able to take more nourishment, and perhaps perspires—a good symptom. If within two hours the temperature rises again, allow it to last for one hour, and then immerse the patient in the bath again; for the danger to be feared is heart failure from exhaustion, and experience proves that cold increases the muscular strength of the heart, tones up the nervous system, stimulates the secretory glands, and allows of perspiration. Medicinal antipyretics, as alcohol, ultimately only still further fatigue the heart, and the antipyretics of the carbolic-acid class, as antipyrine, antifebrin, and quinine, should not be given, as they are cardiac depressants.

Other Uses.—The application of cold to the chest in *pneu-*

monia is not to be recommended, as it increases the congestion, and experience does not justify its use. Nor should it be used in *peritonitis*, except where the inflammation is localized. In those cases of *perityphlitis* caused by perforation of the appendix, where there is only local inflammation and no abscess threatening general peritonitis, the ice bag may be used, and in many cases the inflammation will be reduced without the necessity of any surgical operation; though, if treatment by cold is not successful, recourse must be had to laparotomy. In some fevers, such as *measles*, for example, cold need not be used, and very rarely if ever in *small-pox*. In *scarlet fever*, which does not last for so long a period as typhoid fever, and where, consequently, the muscular exhaustion is not so great, a temperature of 104° may be allowed for two or three days; but if it lasts for a longer time or reaches 105°, cold should certainly be used.

Heat.

The actions of heat differ essentially, according as it is *dry* or *moist;* the effect of one being directly opposed to that of the other.

Dry Heat.

Dry heat gives the simple action of heat. It is primarily a *cardiac and vascular stimulant*. It causes both stronger and more frequent contractions of the heart, and its use is of special value in all cases of failure or exhaustion of that organ. Cardiac failure is liable to occur in malignant, intermittent, and remittent fevers, cholera, the exanthemata, and notably in typhus fever, and sometimes in typhoid and in congestive malarial chills. The symptoms of cardiac exhaustion, with a tendency to stop in diastole, are: a terribly distressing sensation of sinking in the epigastrium; dyspnœa due to congestion of the lungs, producing shallow or gasping respirations; loss or alteration of the voice; insatiate thirst, due to congestion of the viscera; suppression of urine; pallor of the surface and coldness of extremities, with cramps in the flexor muscles, shrivelled skin, and anxious, drawn expression, with sharp, pinched features and sunken eyes. The surface of the body is generally covered with a cold, "clammy" sweat, and in exanthemata the eruption disappears, as no blood reaches the surface. In such cases, the heart must be aroused, both by the internal administration of brandy and ammonium, or by injection, and by the external use of dry heat. Wrap the patient in warm flannel blankets, then apply to the epigastric and pericardiac regions saucers heated by being dipped in boiling water, bottles of hot water, or bags filled with hot salt, ashes, etc. Dry heat should also be applied to the feet and calves of the legs, care being taken that these do not scorch the skin.

If these means fail, then place the patient in a bath with a temperature of 102°–103° F. Mustard or capsicum may be used to increase the stimulant action of the bath (ten grains of the powder to ten gallons of water). Another remedy is the use of the faradic current, one pole being placed at the nape of the neck, the other directly over the heart. The first indication of recovery is disappearance of the distress in the epigastrium, accompanied by a deep sigh and normal respiration; the voice returns to its natural sound; the cramps are relieved; the pallor, shrunken and "Hippocratic" expression of the countenance disappear, and if an eruption has previously existed it returns.

As an Emmenagogue.—In most cases of *amenorrhœa*, and especially in *chlorosis,* the patient suffers from cold feet, on account of the relation which exists between the pedal circulation and that of the pelvic viscera, irritation of the ovarian plexus contracting the femoral artery and its branches. In these cases, it will be found that the long-continued use of the foot-stove during the day, and a hot soapstone at the feet in bed, will do more toward establishing the menstrual and other disordered functions than any other one line of treatment; for by this means the radiated ovarian irritations, which are at the bottom of all the trouble, are suspended, and the intestines are left free to perform their work. In order to encourage the patients to persevere in keeping their feet warm, it is well to inform them that by so doing they will be relieved of the backache from which they all suffer. In *sudden suppression of the menses,* a hot pediluvium or other hot applications to the feet are among the best means of restoring the flow.

As a Diaphoretic.—To induce diaphoresis, strip the patient and roll him up in a hot blanket. The hot-air bath is given by placing the patient on a chair under which has been placed a lighted alcohol lamp; a blanket pinned closely around the neck and reaching to the floor confines the heated air. If the patient is too weak to sit up, the heated air may be introduced under the bedclothes, which have been elevated so as to form a kind of tent.

The sudoriparous glands are stimulated both by the presence of heat and also by the large amount of blood which has been determined to the surface. Diaphoresis is assisted by thoroughly anointing the body with olive oil.

As a Styptic.—Under certain conditions, hot water has the effect of dry heat, and acts as a styptic. In order to obtain this effect, it is necessary that the water, through its high temperature, should produce a *shock* to the nerves and so constringe the blood-vessels. *Post-partum hemorrhage* may sometimes be controlled by douching the spine with very hot water. A more certain way is by hot-water injections, 110°–112° F., thrown into the vagina, or into the uterus itself.

Moist Heat.

Moist heat is an anodyne and antispasmodic, being a pure sedative, the action not being that of the heat but of the water itself. If of low temperature, water is not felt by the nerves, the impression of cold only being conveyed, because the contraction of the unstriped muscular fibres has withdrawn the cutaneous nerves, and the skin has accumulated over the papillæ, producing the appearance known as goose flesh. If the water is of high temperature, there will be the stimulation of heat. Water, however, of the temperature of the body, 98.5°, gives us the full effect of moist heat, which is invariably depressing, as it abstracts nervous vitality; the hand, for instance, if immersed in warm water for half an hour, loses the sense of feeling and muscular power, and it is some time before this is fully recovered from. So after immersion for the same length of time in a bath of this temperature, a person feels faint, the muscular system does not respond to motor impulses, and sensory impressions are deadened. Hence, for the purposes of stimulation, a hot bath should always be of short duration, two minutes at the outside; for, as soon as the temperature of the water is lowered, the patient will be subject to the depressing effect of moist heat.

In the form of poultices, moist heat may be used in *acute inflammation* to relieve the pain and to reduce the irritability. The drawback to its use for this purpose is that the vitality of the part is lowered; parts which had hitherto resisted the suppurative process now yield, and it is necessary to use caustics to restore the weakened reparative power. In all inflammations of the internal organs, such as *pleurisy, pericarditis, pneumonia, peritonitis,* etc., the application of a large, warm poultice or fomentation over the whole region of the affected organs, by taking advantage of the laws of vaso-motor nervous association (supra, p. 277), will often give decided relief. The soothing effect will be increased by adding neurotics to the application.

In *acute articular rheumatism,* the profuse perspiration may do harm by drenching the linen, thus chilling the patient and weakening the heart's action. The patient should be stripped and wrapped in flannel blankets, which absorb the perspiration and are poor conductors of heat. During the entire course of the disease, a warm poultice or a pad of cotton batting, covered with oil-silk, should be kept over the præcordial space.

The antispasmodic action of the warm bath is well illustrated by its power to relax the tissues around a strangulated hernia, and by its efficacy in *renal* and *biliary colic, urethral spasms,* and in the *convulsions* of children. As soon as the breathing of a child becomes rapid, and there is paleness about the mouth, place it in a bath at once, for by this means the convulsion may be prevented, or, if it has already occurred, its duration will be shortened and the liability to repetition diminished.

In all forms of *laryngitis, croup, diphtheria,* etc., the inhalation of steam is very useful; for in all of these diseases there is danger of asphyxia, resulting from spasm of the glottis, and paralysis of the vocal cords due to the irritation.

Mix four parts of water with one of molasses, and introduce steam through a tube into a tent which envelops the head and shoulders of the patient, keeping the temperature of the air moderately high. The tent may be made of newspapers pinned together, a sheet, or anything which confines the vapor. It must not be made too small, or the patient will imagine that it interferes with his breathing. Care must be taken not to boil too long, as the vapor of molasses then becomes irritating.

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